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Dairy and Other Livestock Production Costs in Medina County, Ohio

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OHIO
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CONTENTS

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DAIRY AND OTHER LIVESTOCK PRODUCTION COSTS IN MEDINA COUNTY, OHIO

F. L. MORISON

This bulletin presents an analysis of the livestock production costs of 23 farms in the east-central part of Medina County, in the heart of the dairy region of northeastern Ohio. The data were collected during the 5-year period ending December 31, 1924. The complete cost-route method was used in this study, the farmers, whose businesses these data represent, keeping the records.* An effort was made to select typical farmers, men who had attained different degrees of success in their occupation. Some of the tables show a wide range in the efficiency and success of the production methods of the farmers whose records were obtained.

TYPE OF FARMING

CROPPING PRACTICES

The average size of farm was 135 acres—80 in crops; 37.4 in permanent pasture; 9 in woods not pastured; 3.8 in orchard; and 4.4 in farmstead, road, lanes, and waste. Table 1 shows that during the 5 years 12.1 percent of the area of these farms was in corn, 9.5 percent in oats, 12.1 percent in wheat, 12.4 percent in mixed clover and timothy hay, and 8.7 percent in timothy.

About three-fifths of the total farm area was in crops, and almost exactly one-half in hay and pasture land combined. The rotation most commonly followed was a 5-year rotation of corn, oats, wheat, mixed hay, and timothy.

*This study was conducted jointly by the Department of Rural Economics of the Ohio State University and the Ohio Agricultural Experiment Station and the Division of Farm Management and Costs of the Bureau of Agricultural Economics, U. S. Department of Agriculture. The thanks of the author and the departments making this study are due to the following farmers for their cooperation in furnishing the data from which this bulletin was prepared:

Abbott, Carl B.
Abbott, Geo. F.
Benedict, F. H. and Son
Blakeslee, E. B.
Bohley, C. G.
Chapman, Theodore
Clark, H. W.
Clark, W. R.
Culler, O. R.
Damon, C. W. and Son
Hostetler, F. W.
Lance, Harry
Lance, R. E.
Moore, Guy D.
Nettleton, E. W.
Peebles, F. W. and Sons
Rose, F. J. and Sons
Siman, L. M.
Simmons, Gay O.
Snyder, J. A.
Strong, R. W.
Wideman, H. B.
Woodruff, E. E.

TABLE 1.—Utilization of Land Area, Average of 23 Farms, 1920-1924

Item	Acres	Percent of total area
Corn, for grain	7.6	5.6
Corn, for silage and soilage	8.7	6.5
Oats	12.8	9.5
Wheat	16.3	12.1
Mixed clover and timothy hay	16.7	12.4
Timothy hay	11.7	8.7
Alfalfa	.3	.2
Soybeans	.8	.6
Potatoes	2.4	1.8
Other crops	2.2	1.6
Rotation pasture	.5	.4
Total rotated area	80.0	59.4
Permanent pasture	37.4	27.8
Woods	9.0	6.7
Orchard	3.8	2.8
Yard, lanes, waste, etc.	4.4	3.3
Total farm area	134.6	100

A little more than half of the corn was put into the silo or fed green. Silos were found on all but 3 of the 23 farms. About one-eight of the corn land was seeded in wheat; approximately three-fourths was plowed the next spring for oats; and the remainder was utilized by soybeans, barley, potatoes, and second-crop corn. Oats, with very few exceptions, were followed by wheat, in which a mixture, principally of medium red clover and timothy, was seeded early the next spring. In some cases good crops of clover hay were secured the first year following wheat, in others the clover failed and the hay was largely timothy. Meadows on more than half of the farms were allowed to stand the second year, and on a considerable number of fields timothy hay was cut two or three years in succession. Alfalfa was grown on only two of the farms. One-half of the total soybean acreage was grown in 1923. On eight of the farms that year a total of 32 acres was grown, largely for hay.

Fig. 1.—This study was carried on in the east-central part of Medina County. Conditions in this area are typical of a large part of the northeastern dairy section of Ohio.

Table 2 shows the yields per acre of the principal crops. Both field and silage corn were very poor in 1924, but a good crop of hay helped to overcome the shortage of those feeds. For the 5 years, corn averaged 38.5 bushels, silage 5.8 tons, oats 39 bushels, wheat 18 bushels, mixed clover and timothy hay 1.8 tons, and timothy 1.4 tons per acre.

TABLE 2.—Crop Yields: Average on All Farms, by Years and for the Five-year Period, 1920-1924

Crop	Average yield per acre					
	1920	1921	1922	1923	1924	1920—1924
Corn.....bushels..	30.3	43.5	39.1	44.6	15.6	38.5
Silage .....tons..	6.2	7.6	6.6	6.9	2.4	5.8
Oats.....bushels..	43.6	33.1	35.3	45.6	34.1	38.8
Wheat.....bushels..	16.5	15.8	16.2	20.1	20.8	17.9
Clover and mixed hay.....tons..	2.1	1.9	1.8	1.4	2.0	1.8
Timothy hay..... .....tons..	1.7	1.5	1.6	1.1	1.6	1.4

About one-half of the soil on these farms is of heavy texture with rather poor underdrainage and acid reaction. This condition resulted in poor crops of clover on some of the farms. The cattle on the average farm here would eat about 18 tons of hay annually and the four horses about 10 tons. After taking a few sheep into account, a total of a little more than 30 tons of hay would be required annually per farm to furnish the dry roughage needed besides the stover that is saved. A four-year rotation of corn, oats, wheat, and clover would provide 20 acres of hay, or one-fourth of the 80 acres in crops. With average yields of 1.8 tons per acre this would provide 36 tons of mixed clover and timothy hay, plenty of hay for the livestock carried but just barely enough in a year of poor hay yields, such as 1923. The 5-year rotation has been adopted, no doubt, to guard against a possible hay shortage, tho it can hardly be called a good practice. Until recently the surplus timothy could be sold to good advantage in the city markets. The chief difficulty with the 5-year rotation is that it does not yield enough legume hay for efficient dairying. Tile drainage and liming are needed so that clover can be grown more successfully. The lack of legume hay limits milk production on some of the farms, or else causes the expenditure of considerable sums for protein concentrates to make up the deficiency. Then too the yields of corn, oats, and wheat could be increased, following the shortening of the rotation and the introduction of more legumes, making possible the keeping of more livestock or the selling of more grain.

DESCRIPTION OF LIVESTOCK

Table 3 shows the average amounts of each kind of livestock on the farms studied and also the range in the amounts among the different farms.

TABLE 3.—Livestock of Farms Studied

Item	Amount of stock per farm		
	Average 23 farms	Maximum	Minimum
Milk cows, number of head	11.0	20.0	2.0
Other cattle, animal units*	3.3	7.5	.0
Poultry, number of head	188.0	1,312.0	28.0
Sheep, number of ewes	11.0	99.0	.0
Hogs, hundredweight produced	10.3	53.5	.0
Horses, number of head	4.0	6.0	2.0

*"Animal unit" is used as a measure of the amount of livestock in terms of one horse, one cow, or a feed-consuming equivalent. One bull, two heifers, or three calves are considered as an animal unit.

Dairy cattle were the most important class of livestock on most of the farms, the herds ranging in size from 2 to 20 cows. Five farms had 5 cows or less, five had 6 to 10 cows, eight had 11 to 15 cows, and five had 16 to 20. The large amount of permanent pasture and the excellent market facilities made dairying the leading enterprise. All of the farms save one kept young dairy cattle in addition to a milking herd. Flocks of poultry varied in size from 28 to 1,312 head. Omitting the one farm with the large number of birds, the flocks on the other 22 farms averaged 158 chickens each. Sheep were kept on only 6 farms. The numbers of ewes in these flocks were as follows: 99, 95, 23, 18, 14, and 5. At one time sheep raising was an important enterprise in Medina County, but the number has been rapidly decreasing since the eighties, along with the increasing importance of dairying. Hogs were kept on 17 of the farms. Only 13 of the 23 farms had hogs each year that records were secured.

SOURCES OF INCOME

Table 4 shows that dairy cattle, poultry, wheat, and hay were the outstanding sources of income on most of the farms studied; cattle furnishing 50.1 percent of the total gross receipts, poultry 10.5 percent, wheat 6.3 percent, and hay 5.7 percent. In calculating the receipts, other than dairy products, from cattle, the cost of cows and other cattle purchased was subtracted from the sum of sales and increase in inventory value of all cattle to find the net increase figure. Actual sales of cattle amounted to $476 annually per farm.

Wheat was the principal cash field crop raised. The sales of corn and other grains were almost negligible. A surplus of hay was raised on most of the farms. One-third of the total amount of hay produced during the 5-year period was sold. Total sales of fruits and vegetables amounted to 9.1 percent of the total receipts of the entire group of farms. However, 96 percent of the income from this source was received on two farms that specialized in fruit. Fruit and vegetable sales on the other 21 farms were insignificant, yielding only four-tenths of 1 percent of their income. The item "other crops" includes potatoes, maple syrup, straw, timothy seed, and miscellaneous other crops.

TABLE 4.—Sources of Gross Income on the 23 Farms, 1920-1924

Sources of income	Farms reporting	Average annual gross income 23 farms	Percentage of total receipts from the different sources		
			Average 23 farms	Maximum	Minimum
	No.	*Dol.*	*Pct.*	*Pct.*	*Pct.*
Dairy products*	23	1995.73	45.3	76.8	3.4
Cattle†	22	212.22	4.8	23.7	0
Poultry and eggs†	23	460.86	10.5	43.5	1.0
Sheep and wool†	6	120.77	2.7	23.4	0
Hogs†	17	104.14	2.4	20.4	0
Total livestock‡	23	2893.72	65.7	91.2	29.4
Wheat	21	278.88	6.3	16.2	0
Corn, oats, etc.	15	29.12	.7	6.6	0
Hay	20	249.16	5.7	20.6	0
Fruits, vegetables	17	400.44	9.1	53.7	0
Other crops	19	185.52	4.2	37.9	0
Total crop sales	23	1143.12	26.0	69.4	2.8
All other receipts	23	367.58	8.3	29.0	1.1
Total gross income	23	4404.42	100.0	.....	.....

*Value, at the farm, of all dairy products sold and used in the household.

†Net increase, calculated by adding sales, increase in inventory value, and value of stock, etc., used by the household, and subtracting from this total the sum of livestock purchases and marketing expenses.

‡Other than horses.

DAIRY ENTERPRISE COSTS

MILK PRODUCTION COSTS

As shown in Table 4, 45.3 percent of the gross receipts on these farms were from dairy products. Three of the farms are not included in the dairy cost tables, since dairy products comprised less than 6 percent of their gross farm receipts. A large part of their production was used in the household. Three of the twenty farms included in the milk cost tables had Jersey cattle; two of

TABLE 5.—Items of Cost of Keeping a Cow a Year, Credits per Cow Other Than Milk, and Farm Cost and Selling Price per 100 Pounds of Milk, Averages of All Farms by Years, 1920-1924

Item	5-year average (all farms)		1920 (13 farms)		1921 (13 farms)		1922 (14 farms)		1923 (16 farms)		1924 (14 farms)	
	Amount	Value	Amount	Value	Amount	Value	Amount	Value	Amount	Value	Amount	Value
		Dol.		*Dol.*		*Dol.*		*Dol.*		*Dol.*		*Dol.*
Annual cost per cow:												
Concentrates	2,366 lb.	50.14	2,117 lb.	69.56	2,161 lb.	40.48	2,243 lb.	38.71	2,470 lb.	45.32	2,867 lb.	56.36
Succulent feed	8,630 lb.	25.18	9,225 lb.	41.84	8,675 lb.	24.15	10,842 lb.	21.99	8,074 lb.	18.58	6,246 lb.	18.81
Dry roughage	3,209 lb.	21.81	2,959 lb.	32.65	2,650 lb.	18.58	2,928 lb.	13.35	3,702 lb.	20.23	3,790 lb.	23.92
Pasture	166 da.	10.79	164 da.	13.36	172 da.	8.20	163 da.	10.94	161 da.	10.41	172 da.	10.96
Total feed and pasture		107.92		157.41		91.41		84.99		94.54		110.05
Straw bedding	1,675 lb.	4.42	1,579 lb.	3.95	1,563 lb.	4.65	1,312 lb.	3.66	2,099 lb.	5.24	1,783 lb.	4.52
Man labor	159 hr.	43.36	143 hr.	41.14	162 hr.	43.84	167 hr.	41.46	158 hr.	43.93	167 hr.	46.66
Building charge		5.26		4.69		4.72		5.27		5.89		5.70
Equipment charge		8.92		8.93		7.72		11.65		8.22		8.16
Interest on cows		5.67		5.65		5.51		5.80		5.65		5.76
Taxes and insurance		1.57		1.37		1.29		1.59		1.82		1.78
Depreciation		9.96		10.15		9.45		9.01		9.60		11 21
Bull service		7.71		9.95		7.58		5.85		7.29		7.75
Other costs*		13.56		14.16		15.21		12.43		13.04		13.41
Total cost*		208.35		257.40		191.38		181.71		195.22		215.00
Credits other than milk:												
Manure		9.05		9.49		7.30		10.06		9.46		8.83
Calf	.76	6.83	.70	8.80	.79	7.00	.77	6.37	.80	7.07	.73	4.65
Miscellaneous		.10		.25		.08		.08		.03		.07
Total credits		15.98		18.54		14.38		16.51		16.56		13.55
Net cost of milk		192.37		238.86		177.00		165.20		178.66		201.45
Production per cow	7,386 lb.		6,964 lb.		6,782 lb.		7,330 lb.		8,110 lb.		7,705 lb.	
Cost per 100 pounds milk*		2.60		3.43		2.61		2.25		2.20		2.61
Average selling price†		2.67		3.55		2.61		2.14		2.69		2.38

*Excluding hauling costs.
†Net price received at the farm.

these three farms sold sweet cream and one sold milk. The other seventeen farms had Holsteins and sold wholesale market milk. The average butterfat test of the milk sold was obtained, and, to place all farms on a comparable basis, the milk production figures were converted to an equivalent amount of milk containing 3.5 percent of butterfat.

VARIATION IN COST FROM YEAR TO YEAR

The cost of producing any finished product will vary from year to year, depending on the number of units of raw materials going into each unit of product and the cost of each of the ingoing cost elements. Thus, in connection with the cost of producing milk during a series of years, different amounts of the various feeds will be fed per cow, owing to different degrees of scarcity of home-grown feeds, changes in prices of feeds, the quality and length of the pasture season, prices of milk, etc. Man labor rates will vary from year to year, as will some of the other items of cost.

Table 5 shows that the cost of keeping a cow, on the average, was highest in 1920, fell the next year, reached the low point in 1922, then rose in 1923, and was still higher in 1924, being that year about 84 percent of the 1920 cost.

Table 5 shows the averages per cow of all the various cost factors, the average production per cow, average cost and average selling price per hundred pounds of milk for each of the five years. The main cause for the wide differences in average cost of keeping a cow during the different years was the range in feed costs.

TABLE 6.—Values of Some of the Principal Cow Feeds, Average of All Farms, by Years, 1920-1924

Item	Average	1920	1921	1922	1923	1924
	Dol.	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*
Corn and cob meal, per cwt.	1.58	2.50	1.45	1.22	1.30	1.56
Ground oats, per cwt.	1.97	3.22	1.83	1.48	1.54	1.81
Silage, per ton.	5.92	9.07	5.57	3.97	4.62	6.04
Hay, per ton	16.17	26.74	16.81	11.51	12.56	14.06
Linseed meal, per cwt.	2.98	4.03	2.53	2.90	2.83	2.58
Cottonseed meal, per cwt.	2.83	3.86	2.28	2.76	2.91	2.82
Bran and middlings, per cwt.	1.84	2.65	1.66	1.66	1.72	1.90
Gluten feed, per cwt.	2.64	3.82	2.01	2.38	2.57	2.36
Other concentrates, per cwt.	2.66	4.08	2.42	2.07	2.51	2.26

The average values of some of the principal dairy feeds are shown in Table 6. The lowest average yearly prices for homegrown feeds were in 1922, and since these feeds made up the highest proportion of the total feed bill, the feed cost per cow and incidentally the total costs were lowest in that year. The average annual price of most of the purchased concentrates was lowest in 1921.

RELATIVE IMPORTANCE OF VARIOUS COST ITEMS

As a 5-year average on all farms, feed and pasture formed 51.8 percent of the total cost of keeping a cow, as shown in Table 7. This item was 61.2 percent of the total cost in 1920 and 46.8 percent in 1922. Labor was next in order of importance, averaging 20.8 percent of the total cost for the 5-year period.

TABLE 7.—Percentage Distribution of the Items of Cost of Keeping a Cow, Averages of All Farms by Years, 1920-1924

Item	Division of cost					
	Average	1920	1921	1922	1923	1924
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Feed	46.6	56.0	43.5	40.8	43.2	46.1
Pasture	5.2	5.2	4.3	6.0	5.3	5.1
Bedding	2.1	1.5	2.4	2.0	2.7	2.1
Man labor	20.8	16.0	22.9	22.8	22.5	21.7
Building charge	2.5	1.8	2.5	2.9	3.0	2.7
Equipment charge	4.3	3.5	4.0	6.4	4.2	3.8
Interest on cow	2.7	2.2	2.9	3.2	2.9	2.7
Taxes, insurance	.8	.5	.7	.9	.9	.8
Depreciation	4.8	3.9	4.9	5.0	4.9	5.2
Bull service	3.7	3.9	4.0	3.2	3.7	3.6
Other costs	6.5	5.5	7.9	6.8	6.7	6.2
Total	100	100	100	100	100	100

The table also shows the relative importance of the other factors. Costs other than feed, pasture, and labor amounted to 27.4 percent of the total cost.

FARM-TO-FARM VARIATIONS IN COST

Table 8 shows individual farms, with cost items per cow and cost per hundred pounds of milk produced. Some of the farms kept records for the full five years; others kept records during the first two or three years; and as these dropped out others were added. To make all farms comparable as to cost per hundred pounds of milk, adjustments had to be made. How these were made is shown in the following example: Records were secured on Farm 23 during the year 1923 only. The average cost of producing milk on that farm in 1923 was $1.857 per hundred. The average cost of all milk produced by all of the farms in that year was $2.203 per hundred pounds. The five-year average cost of all milk produced was $2.604 per hundred. Then to make Farm 23 comparable with the five-year average we assumed that its cost for that period would bear the same relation to the average cost of milk produced on all farms as it did in 1923. By the proportion

TABLE 8.—Variations in Annual Cost of Keeping a Cow, Production per Cow, and Cost per Hundred Pounds of 3.5 Milk at the Farm, by Farms, 1920-1924

Farm	Total milk produced, all years	Size of herd	Annual cost per cow														Milk per cow, 3.5% test	Cost per 100 lb. of milk	
			Feed and pasture	Straw bedding	Man labor		Building charge	Equipment charge*	Interest on cows	Taxes, insurance	Depreciation on cows	Bull service	Other†	Total	Credits other than milk‡	Net cost of milk		Actual	Adjusted
					Amt.	Value													
	Lb.	*Cows*	*Dol.*	*Dol.*	*Hr.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Lb.*	*Dol.*	*Dol.*
3	544,653	13.8	97.54	4.25	171.7	44.35	2.62	3.38	4.93	1.63	6.86	4.43	12.06	182.05	14.77	167.28	7,866	2.13	2.13
10	457,016	12.4	118.82	4.18	151.3	41.65	7.05	19.76	11.95	2.71	4.70	17.80	15.12	243.74	45.50	198.24	9,220	2.15	2.15
17	278,545	13.3	122.58	6.30	174.1	54.42	3.40	5.36	5.06	1.57	8.32	5.02	11.43	223.46	13.77	209.69	10,479	2.00	2.17
23	77,200	7.9	89.30	9.49	168.0	50.40	6.81	7.69	4.40	1.67	11.23	2.13	15.60	198.72	17.45	181.27	9,760	1.86	2.19
14	436,551	18.7	114.29	3.21	99.0	29.84	5.76	9.60	5.18	.90	5.19	7.09	13.76	194.82	13.08	181.74	7,762	2.34	2.20
6	384,821	8.2	122.73	5.06	143.5	43.13	9.35	2.63	4.89	1.07	21.54	.55	11.25	222.20	11.37	210.83	9,370	2.25	2.25
12	326,090	11.7	91.33	1.98	196.9	58.44	5.39	9.47	5.99	2.12	4.84	13.76	17.85	211.17	15.44	195.73	9,277	2.11	2.34
2	575,410	20.0	75.45	2.78	133.6	33.06	4.51	5.34	4.10	1.86	6.62	6.19	9.59	149.50	12.77	136.72	5,764	2.37	2.37
1	213,495	4.9	94.56	8.32	172.1	48.23	5.98	8.23	8.90	2.72	27.34	4.26	14.05	222.59	14.16	208.43	8,686	2.40	2.40
22	244,686	16.3	127.08	4.02	121.8	33.36	8.72	12.48	6.07	1.32	12.27	8.84	21.95	236.11	14.13	221.98	7,492	2.96	2.53
7	135,158	3.9	93.07	4.58	185.7	55.04	2.15	.62	3.80	.87	8.30	2.34	16.49	187.26	12.10	175.16	6,882	2.55	2.55
20	223,335	13.5	158.29	4.33	214.5	62.83	2.37	2.62	7.42	2.45	9.89	14.23	18.78	283.21	18.66	264.55	8,275	3.20	2.75
5	323,858	7.7	132.73	6.33	197.2	59.07	2.94	5.55	5.95	1.37	12.88	9.19	18.25	254.26	15.49	239.47	8,416	2.84	2.84
11	202,041	8.0	112.25	2.52	229.9	49.37	7.37	13.57	5.62	1.25	10.83	18.43	18.70	239.91	17.95	221.96	8,394	2.64	2.93
18	233,250	13.9	123.07	5.17	193.5	57.49	8.87	11.20	6.85	1.23	6.75	13.96	14.72	249.31	18.61	230.70	8,381	2.75	3.00
16	82,814	5.8	106.73	6.97	153.5	44.90	8.21	16.15	6.17	1.66	10.14	1.29	12.06	214.28	18.27	196.01	7,102	2.76	3.01
13	337,125	16.5	87.46	3.89	143.1	40.99	5.61	19.49	6.44	1.14	15.65	4.77	15.01	200.45	15.08	185.37	6,813	2.72	3.02
8	375,661	12.3	116.07	5.72	186.0	42.44	4.94	7.18	4.74	1.51	10.78	11.33	8.94	213.65	15.77	197.88	6,127	3.23	3.23
15	177,240	10.6	118.70	5.12	118.3	34.85	4.13	11.18	5.09	1.36	9.30	2.62	15.05	207.40	15.02	192.38	5,598	3.44	3.24
4	375,427	15.8	109.62	4.23	155.1	39.17	4.68	10.45	3.88	1.25	8.91	4.65	11.47	198.31	9.02	189.29	4,753	3.98	3.98
Av.	6,004,376§	11.6	107.92	4.42	159.1	43.36	5.26	8.92	5.67	1.57	9.96	7.71	13.56	208.35	15.98	192.37	7,386	2.60	2.60

*Equipment charges include all charges on dairy equipment such as cans, pails, strainers, stable equipment and milking machines, a share of the total operating costs of water supply equipment, lighting systems and feed grinders, and a share of the total operating costs of farm automobiles and trucks used for hauling feed or trucking cows. Milk hauling costs are not included.

†Other costs include the following: overhead charges averaging $9.37 per cow, cow-testing expenses averaging $1.30, horse work 7.6 hours costing $1.55, medicines, disinfectants, and veterinary services $0.92, salt $0.38, and advertising $0.04.

‡Credits other than milk include value of manure averaging $9.05, calf credit averaging $6.83 and feed bags $0.10.

§Total milk produced on all farms.

$1.857 : $2.203 : : X : $2.604, we get an adjusted cost of $2.195 for Farm 23. Hence in Table 8 those farms whose adjusted cost was the same as the actual cost kept records during the entire five years; those whose adjusted cost was higher than their actual cost kept records during the years of relatively low costs; and those whose adjusted cost was lower than their actual cost kept records only during a period of relatively high costs.

The average cost of producing milk on these farms during this five-year period was $2.60 per hundred pounds, exclusive of all hauling costs. During this time the average net selling price received at the farm was $2.67 per hundred pounds.

The 5-year average cost of producing milk on individual farms ranged from $2.13 per hundred pounds on Farm 3 to $3.98 on Farm 4, a variation of $1.85 per hundred, or 87 percent. The costs on individual cows were not obtained, but it is entirely possible that some cows produced milk at $1.75 or less and others at $6.00 or more per hundred. These variations are due, of course, to wide differences in the value of the elements entering into the cost of keeping the cow as well as to differences in production per cow. An examination of the table will show that 11 of the 20 farms had production costs lower than the average cost of all farms. These 11 farms produced 61.2 percent of all the milk produced on the 20 farms.

Low cost per hundred pounds of milk is desirable, not as an end in itself, but as a means to an end, that being highest total profit. The man who makes the highest profit is not necessarily the one who produces at lowest cost per unit. Thus, one dairyman, A, may have a very small herd and by intensive methods produce at rather low cost per hundred pounds of milk. Another dairyman, B, with a large herd may make a higher total income even if his production cost per hundred pounds is slightly more than A's. Size of business is an important factor in determining profits and should not be completely overshadowed by discussions of methods of reducing costs of each unit of product.

Table 9 shows how total dairy profits per farm varied on the five low-cost farms, placing a flat value of $2.67 per hundred pounds on the milk produced.

Farm 14 was fifth lowest in cost per hundred pounds of milk but ranked second in total amount of dairy returns over total costs. Farm 17 was third in cost per hundred, but, with the highest production per cow and more than the average number of cows, stood first in total profits from dairying.

Variations in feed.—The quantities and kinds of feeds fed to dairy cows were varied by individual farmers according to their judgment and ability as dairymen and also according to the supplies of home-grown feeds on hand. In general the cows that were fed the most liberally were the high producers. The values of feeds shown in Table 8 are of little significance in studying the effect of feed on production, for they represent in some cases the value of feed fed during periods of relatively high prices and in others during relatively low prices. The effect of different methods of feeding will be discussed in more detail later.

TABLE 9.—Relation of Cost of Production, Annual Production per Cow, and Number of Cows to Total Dairy Profits, 5 Low-cost Farms

Farm	Per 100 pounds of milk		Annually, per cow		Number of cows	Total dairy profit
	Cost	Profit	Production	Profit		
	Dol.	*Dol.*	*Lb.*	*Dol.*	*No.*	*Dol.*
3	2.13	0.54	7,866	42.48	13.8	586
10	2.15	.52	9,220	47.94	12.4	595
17	2.17	.50	10,479	52.39	13.3	697
23	2.19	.48	9,760	46.85	7.9	370
14	2.20	.47	7,762	36.48	18.7	682

Variations in labor.—In calculating labor cost the farm operator's labor was figured at an average of 30 cents an hour thruout the year, that rate being slightly more than the total wage rate for dependable hired labor. Hired labor costs, including cash and all extras furnished to the hired men, averaged a little over 23 cents an hour, ranging on the different farms from 35.4 cents to 14.8 cents. The weighted average value of all labor performed by operators and hired men was 27.3 cents an hour.

Labor input per cow varied from 99 hours to 230 hours a year. Some of the factors influencing labor expenditure per cow are as follows:

Size of business.—Herds of 8 cows or less received an average of 191 hours per cow annually, while those of 15 or more received an average of 133 hours. On the ten smallest herds the average was 176 hours and on the other ten farms 150 hours per cow. Such differences are due partly to the fact that many of the operations in the feeding, care, and general management of a herd take a fixed amount of time regardless of the size of the herd, and also to the fact that the small herd does not provide a sufficient size of business to warrant the making of labor- saving improvements.

Milking machines.—Milking machines were used on Farms 10, 14, 2, 22, 15, and 4 during the entire period covered by these

records. (See Table 8). Three other farms, 12, 16, and 13, had milking machines installed during the early part of 1924. The average labor expenditure per cow on these three farms was 187 hours a year for the years before milking machines were used and 134 hours in 1924 when they were used. The average annual labor expenditure per cow on all farms using milking machines was 133 hours, while on farms without them it was about 184 hours. Part of this difference was undoubtedly due to the smaller labor requirement per cow for such operations as feeding, cleaning the barn, etc., in large as compared to small herds. Table 10 shows the differences in labor and equipment charges under the two different sets of conditions.

TABLE 10.—Labor and Equipment Charges on Cows on Farms With and Without Milking Machines

Item	Farm year-records	Size of herd	Labor per cow annually		Annual equipment charges	
			Amount	Value	Total	Per cow
	No.	*Cows*	*Hr.*	*Dol.*	*Dol.*	*Dol.*
Farms with milking machines....	25	15.6	133.0	35.80	165.42	10.59
Farms without milking machines	45	9.4	183.6	50.35	69.16	7.37

Some of this difference in labor expenditure was also due to the fact that six of the farms with milking machines were following less intensive methods of feeding than the average of those that milked by hand.

Production per cow.—On the average, high producing herds required more labor than did low producing herds. As shown later in Table 14, cows in herds producing less than 6,000 pounds of milk per cow received an average of 141 hours of labor annually, whereas the herds producing more than 9,000 pounds received 169 hours per cow. The high producing herds received more feed, both in winter and summer, which took more time. They required less labor per hundred pounds of milk, however, and as a larger proportion of the cows in high producing herds freshened in the fall these herds had the better distribution of labor.

Other factors.—On Farms 8 and 11 (Table 8) a large part of the work was done by inefficient hired help. The hired man on Farm 11 was quite old and got a correspondingly low wage. When the value of the labor expended on cows is compared it is seen that these two farms were near the average figure. On Farms 12, 20, and 11 (Table 8) considerable time was spent in testing individual cows for high production records.

Variation in building charges.—Only a portion of the costs of maintaining the dairy barn was charged to cows. Part was charged to horses, machinery, hay storage, young cattle, and any other livestock enterprises using the building. Cost per cow varied according to the number of cows and to size, value, and condition of the building. Farms 3, 5, 7, 17, and 20 had old barns with low expenditures for upkeep. Building charges per cow were low on these farms in spite of the small number of cows on two of them. On Farms 2 and 14 the barns were large, comparatively new, and kept in a good state of repair, yet the charges per cow were moderately low because of the large number in the herds.

Variations in equipment charges.—As shown in Table 10, the farms that used milking machines had total equipment costs chargeable to cows amounting to $10.59 per cow annually; and those without milking machines, $7.37 per cow. Farms 10 and 13 (Table 8) had high equipment charges because of the extensive use of their trucks in hauling dairy feed. Both of them had milking machines also. Farm 11, altho not having a milking machine, had a high equipment charge because of the use of a truck for hauling feed and trucking cows. Farms 3, 6, 7, and 20 (Table 8) each had a very small outlay of expense for dairy equipment.

Variations in depreciation on cows.—Depreciation on cows amounted to approximately $10 per head per year. This figure was obtained by adding together the beginning inventory value of cows, cost of cows purchased, and the value of heifers freshened (not the cost of raising them), and from this subtracting the sum of all receipts from cows sold or slaughtered, cow hides, and value of cows in the closing inventory, and dividing the result by the number of cow-years represented. Decreases or increases in the market value of dairy cows during this period were disregarded in placing values on cows in the inventories. A total of 70 farm-year records are included in Table 11.

Annual depreciation per cow, as shown in Table 8, varied on the different farms from $4.70 to $27.34. The herd on Farm 10, which had the lowest depreciation, was completely replaced in four years by heifers raised on that farm. The owner of Farm 12 bought no cows but had ten farm-raised heifers freshen during the three years he kept records. Farm 1, whose herd had the highst depreciation per cow, began keeping records in 1920 with five cows. In 1921 four of these cows were condemned on account of tuberculosis, with a very heavy loss. Seven cows were then bought at prices averaging over $210 per head. On Farm 6 the herd was replaced twice in

five years, entirely by purchase. No heifer calves were raised. This herd had more than a normal death loss and in addition two-thirds of its cows were condemned for tuberculosis during the year 1924. Farm 13 also suffered a big depreciation because of bovine tuberculosis.

TABLE 11.—Method of Calculating Annual Depreciation per Cow, 1920-1924

Item	Number	Total value	Value per head
		Dol.	*Dol.*
Cows in beginning inventories	840	77,430.00	92.18
Cows purchased	110	12,361.00	112.37
Heifers that became cows	114	12,785.00	112.15
Total	.....	102,576.00	.....
Cows sold for breeding or slaughter	161	13,685.00	85.00
Cows condemned—T. B.	43	3,467.00	80.62
Cows slaughtered on farm	17	838.00	49.29
Cow hides sold	.....	75.00	.....
Cows died	17	.....	.....
Cows in closing inventories	826	76,410.00	92.51
Total	.....	94,475.00	.....
Depreciation on cows	.....	8,101.00	.....
Number of cow-years	812.9	.....	.....
Annual depreciation per cow	.....	.....	9.96

Table 11 shows that of the cows on hand at the beginning of the year 19 percent were sold, 5 percent were condemned because of tuberculosis, 2 percent were butchered on the farm and 2 percent died, a total displacement of 28 percent per year.

These figures also give an indication of the average milking life of dairy cows. If it is assumed that the cows had an average value of $112 upon freshening and that their average value for beef was $49 per head, this would mean a total depreciation of $63 during the productive life of each cow. Dividing this then by the average annual depreciation gives a milking life of 6.3 years per cow. This may at first seem high considering the fact that more than one-fourth of the cows were replaced each year. It must be remembered, however, that many of the cows on hand in the beginning inventories had already had one, two, or more calves, and also that many of the cows that were sold had not yet passed their period of usefulness, going on into the hands of other farmers.

Variations in production per cow.—The average herd production per cow varied from 10,479 to 4,753 pounds of 3.5 milk, or its equivalent (Table 8). In general, production varied according to quality of the cows, amount and kind of feeds, and season of

freshening. The cows in the herd on Farm 17 were large and rugged and of high capacity, and they were well fed thruout the year. Farm 6 managed to get a high average production by purchase of cows that had just freshened or were about to freshen, keeping them about two years and disposing of them when dry, thus maintaining a smaller percentage of dry cows than did the other farms. Farms 10 and 12 had high producing herds that had been built up by selection of heifer calves from the best cows. The cows on Farms 2 and 4 were generally in poor flesh, being underfed and poorly fed. The larger proportion freshened in the spring of the year, while the cows in most of the herds with a high production per cow freshened principally in the fall. The unhealthy condition of the cows on Farm 4 was largely the cause of their low production. They were tested for tuberculosis in 1924 and the entire herd was condemned. Production on this farm dropped from an average of 5,444 pounds per cow in 1920 to 3,569 pounds in 1924.

UNIT COSTS

Table 12 is a summary of all the various cost factors entering into the cost of keeping an average cow, together with the credits and average production per cow. This does not mean necessarily that this is the production that will be obtained if the stated quantities of feed, labor, and other cost items are expended on a cow during the course of a year, nor that these are the quantities that are necessary for this production to be secured. Most of the hay fed to cows in this region was mixed hay with a predominance of timothy. This made necessary the purchase of considerable oil meal, cottonseed meal, and other protein concentrates to balance the ration. In other sections of the State where there is plenty of clover, sweet clover and alfalfa hay and where sweet clover pasture is available it would not be necessary to use such large quantities of the supplementary feeds. The amounts of feed, the hours of labor, and production per cow will vary according to the intensity of the dairy enterprise, i. e., whether the cows freshen principally in the fall and are fed for uniform production thruout the year or whether they freshen in the spring and produce most of the milk during the pasture season. Labor will vary also according to the size of the herd and the extent to which labor saving equipment is used.

It should be recalled that the average costs presented above are for herds averaging about 12 cows and that milking machines were used on 36 percent of the herds, representing 48 percent of the cows

TABLE 12.—Unit Cost of Keeping a Cow a Year and Cost per 100 Pounds of 3.5 Milk at the Farm, Average of 20 Farms 1920-1924

Item	Amount	Value	
		Per unit	Total
Cost of keeping a cow a year:		*Dol.*	*Dol.*
Feed:			
Corn and cob meal	726 lb.	1.58 per cwt.	11.46
Ground oats	632 lb.	1.97 per cwt.	12.48
Linseed meal	241 lb.	2.98 per cwt.	7.18
Cottonseed meal	147 lb.	2.83 per cwt.	4.16
Bran and middlings	197 lb.	1.84 per cwt.	3.63
Gluten feed	68 lb.	2.64 per cwt.	1.80
Other concentrates	355 lb.	2.66 per cwt.	9.43
Total concentrates	2,366 lb.	2.12 per cwt.	50.14
Silage, other succulent feed	8,630 lb.	5.84 per ton	25.18
Hay	2,379 lb.	16.17 per ton	19.21
Stover	830 lb.	6.27 per ton	2.60
Pasture	166 days	2.00 per mo.	10.79
Total feed and pasture			107.92
Straw bedding	1,675 lb.	5.28 per ton	4.42
Man labor	159 hr.	.273 per hr.	43.36
Building charge			5.26
Equipment charge			8.92
Interest on cow at 5%			5.67
Taxes and insurance			1.57
Depreciation on cow			9.96
Bull service			7.71
Overhead			9.37
Miscellaneous			4.19
Total annual cost			208.35
Credits per cow per year:			
Manure	9.05 tons	1.00 per ton	9.05
Calf	.76 calf	9.00 per head	6.83
Total credits			15.98
Net cost of milk			192.37
Production per cow, 3.5 milk	7,386 lb.		
Cost 100 lbs. milk at farm			2.60

Farm-to-farm variations:
Average production per cow, 4,753 to 10,479 pounds.
Average cost per 100 pounds milk, $3.98 to $2.13.

under study. Of the cows freshening, 23.7 percent freshened in December, January, and February; 30.5 percent in March, April, and May; 16.4 percent in June, July, and August; and 29.4 percent in September, October, and November.

FEED AND OTHER FACTORS AS RELATED TO PRODUCTION

A cow can not produce milk economically if she is underfed, because about half of all the feed that she will eat is required to maintain her body. No doubt a great many good dairy cows fall into the class of low producers simply because they are fed improperly or insufficiently.

In Table 13 the 20 farms are arranged according to average production per cow. The amounts of various kinds of feeds consumed per cow are shown. In general the high producing cows were better fed than the low producers.

On the first 5 farms the average cow received a total of 647 pounds of digestible protein and 4,569 pounds of digestible carbohydrates, the entire ration, excluding pasture, having a nutritive ratio of 1:7.0. The fourth group of 5 farms, those which were lowest in production per cow, averaged only 465 pounds of digestible protein and 3,983 pounds of carbohydrates, exclusive of pasture, with a nutritive ratio of 1:8.6. The cows of the second group of 5 farms were fed a total of 9 percent more grain per cow than those of the first group. This is accounted for by the fact that two of the herds in the first group were Jerseys, while only one herd in the second group was of this breed. The first group was fed slightly more silage and hay, and the hay had a larger percentage of clover in it. The hay on the last 5 farms was largely timothy. There was a very evident decrease in the amounts of oil meal, cottonseed meal, and bran between the upper and lower groups of farms.

Pastures generally must be supplemented if the flow of milk is to be maintained. The extent to which this was done is shown in the same table. In general the high producing cows got more supplementary feed during the pasture season than the low producers. The average pasture season of the last 5 farms was shorter than that of the other groups due to the fact that on Farm 13 only the dry cows received any pasture at all during two of the three years, this making the average pasture season for all cows only 78 days on this farm. The cows on the first 5 farms received 90 percent more grain, 30 percent more silage, green corn, or other succulent feed, and 55 percent more hay per day for every day of the pasture season than did the cows in the 5 low producing herds.

Table 13 also shows that there was a relation between season of freshening and production per cow. Thus there was a large amount of fall freshening in the high producing group, with a relatively small percentage of the cows freshening in the spring. As production decreased, this table shows that there was a decrease in the number of cows that freshened in the fall and an increase in the number that freshened in the spring. This factor will be discussed in more detail later.

TABLE 13.—Production per Cow, Feed Consumption per Cow, and Season of Freshening, by Farms, 1920-1924

Farm number	3.5% milk per cow	Feed consumption per cow														Cows freshening	
		Total per year											Total during pasture season				
		Concentrates								Silage etc.	Hay	Stover	Pasture	Concentrates	Silage etc.	Hay	Spring*	Fall†
		Corn	Oats	Oilmeal	Cottonseed meal	Gluten	Bran	Other	Total									
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Da.*	*Lb.*	*Lb.*	*Lb.*	*Pct.*	*Pct.*
17	10,479	1,557	1,113	268	286	.....	103	53	3,380	10,244	3,596	963	170	1,239	2,339	765	13.8	27.6
23	9,760	1,523	1,403	42	.....	.....	279	.....	3,247	.....	3,395	2,903	188	697	.....	927	22.2	44.4
6	9,370	687	1,070	337	158	75	28	36	2,391	11,827	3,081	947	161	659	1,427	425	15.0	40.0
12	9,277	570	579	758	15	47	240	359	2,568	6,000	1,730	466	149	905	1,674	60	39.4	21.2
10	9,220	493	750	378	310	8	469	634	3,042	6,785	2,693	620	173	1,135	1,610	303	13.5	46.2
Av.	*9,506*	*787*	*887*	*416*	*187*	*32*	*235*	*203*	*2,837*	*8,144*	*2,706*	*839*	*168*	*958*	*1,018*	*389*	*19.6*	*36.2*
1	8,686	612	625	270	197	92	141	253	2,190	7,636	766	2,253	163	543	30	105	13.0	56.5
5	8,416	1,569	870	332	279	237	380	5	3,672	7,007	2,922	1,967	172	1,392	2,344	188	27.8	19.4
11	8,394	677	854	254	231	390	367	346	3,119	7,925	2,842	429	161	1,143	885	681	23.1	42.3
18	8,381	648	905	191	266	135	414	873	3,432	6,147	3,489	716	176	1,198	1,293	453	34.5	31.0
20	8,275	445	439	362	263	48	324	797	2,678	10,391	3,230	.....	157	660	1,723	234	34.8	17.4
Av.	*8,425*	*858*	*750*	*285*	*252*	*182*	*332*	*427*	*3,080*	*7,747*	*2,705*	*1,136*	*166*	*1,026*	*1,377*	*318*	*27.0*	*32.1*

*Spring=March, April, May.
†Fall=September, October, November.

TABLE 13.—Production per Cow, Feed Consumption per Cow, and Season of Freshening, by Farms, 1920-1924—Continued

Farm number	3.5% milk per cow	Feed consumption per cow														Cows freshening	
		Total per year											Total during pasture season				
		Concentrates								Silage, etc.	Hay	Stover	Pasture	Concentrates	Silage etc.	Hay	Spring*	Fall†
		Corn	Oats	Oilmeal	Cotton-seed meal	Gluten	Bran	Other	Total									
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Da.*	*Lb.*	*Lb.*	*Lb.*	*Pct.*	*Pct.*
3	7,866	567	422	161	143	20	165	402	1,880	9,005	2,536	753	170	581	1,458	112	43.6	38.2
14	7,762	591	655	203	189	.....	263	448	2,349	8,665	1,583	594	169	565	898	.....	35.3	27.5
22	7,492	355	491	237	126	28	31	661	1,929	10,005	2,432	.....	168	400	2,965	113	27.3	24.2
16	7,102	857	966	481	125	69	259	258	3,015	2,882	3,387	1,333	198	1,290	343	1,157	27.8	33.3
7	6,882	335	234	169	331	23	376	384	1,852	6,149	2,456	1,161	174	556	89	795	36.8	36.8
Av.	*7,622*	*531*	*517*	*207*	*172*	*19*	*199*	*450*	*2,095*	*8,403*	*2,279*	*654*	*176*	*586*	*1,341*	*215*	*35.8*	*31.8*
13	6,813	632	2	138	161	102	146	350	1,531	13,729	2,903	863	78	422	.....	139	34.0	22.0
8	6,127	642	690	192	10	.....	51	839	2,424	13,245	1,355	482	164	695	2,824	501	31.7	28.3
2	5,764	882	491	126	82	.....	.....	.....	1,581	5,484	2,020	1,068	173	388	453	252	34.2	22.8
15	5,598	739	756	219	58	80	115	206	2,173	11,497	1,258	1,570	174	409	3,299	.....	42.3	26.9
4	4,753	753	652	134	40	170	302	265	2,317	7,796	2,614	330	184	438	598	121	34.7	16.7
Av.	*5,730*	*752*	*520*	*152*	*67*	*65*	*118*	*300*	*1,974*	*9,396*	*2,000*	*702*	*155*	*466*	*1,152*	*233*	*34.5*	*22.6*
Av. of all	7,386	726	632	241	147	68	197	355	2,366	8,630	2,379	830	166	689	1,327	274	30.5	29.4

*Spring=March, April, May.
†Fall=September, October, November.

PRODUCTION PER COW AS RELATED TO COSTS AND RETURNS

In order to have a larger number of records with which to work in studying the relationship between production and profits each farm-year record was considered as a unit. Then instead of having the records of twenty different farms for a period ranging from one to five years there were seventy 1-year records available. This made possible a more detailed sorting and eliminated to some extent diffrences due to inherent quality of the cows, since some farms fell into one production group one year and another group the next, depending on amount of feed. These 70 records were grouped into four classes, based on production per cow, as shown in Table 14.

TABLE 14.—Cost Factors per Cow and per 100 Pounds of Milk in Herds of Varying Production per Cow, Five-year Average 1920-1924

Item	Under 6000 lb. milk		6000 to 7500 lb. milk		7500 to 9000 lb. milk		Over 9000 lb. milk	
Number of farm records	15		17		21		17	
Number of cow-years	222.1		185.1		233.5		172.2	
Average production per cow..Lb.	5289		6656		8206		9765	
Return per $1 worth of feed...Dol.	1.56		1.80		1.87		2.00	
Return per hour of labor.....Dol.	.106		.221		.349		.512	
Labor income per farm.....Dol.	—311.94		—11.70		233.01		684.12	
Cost factors per cow:	*Lb.*	*Dol.*	*Lb.*	*Dol.*	*Lb.*	*Dol.*	*Lb.*	*Dol.*
Concentrates:								
Corn	789	11.93	612	9.93	617	9.83	914	16.21
Oats	530	10.18	571	11.60	568	11.25	922	20.68
Cottonseed meal and oilmeal	243	7.21	263	7.79	457	12.68	610	18.04
Bran and middlings	163	3.07	117	2.42	259	4.53	247	4.31
Other concentrates	291	7.56	358	9.79	593	16.64	431	9.49
Total concentrates	2016	39.95	1921	41.53	2494	54.93	3124	68.73
Succulent feed	7237	21.41	9979	28.10	9247	27.18	8139	24.07
Hay	2019	15.97	2005	15.51	2678	22.57	2827	23.33
Stover	729	2.16	815	2.63	730	2.09	1121	3.59
Pasture	.....	11.19	.....	11.09	.....	10.31	.....	10.61
Total feed and pasture	.....	90.68	.....	98.86	.....	117.08	.....	130.33
Labor	141 hr.	36.56	160 hr.	41.83	168 hr.	46.42	169 hr.	49.63
Other costs*	.....	46.68	.....	59.53	.....	59.12	.....	64.25
Total gross cost	.....	173.92	.....	200.22	.....	222.62	.....	244.21
Credits	.....	11.03	.....	16.05	.....	15.78	.....	20.44
Net cost*	.....	162.89	.....	184.17	.....	206.84	.....	223.77
Returns from milk†	.....	141.22	.....	177.72	.....	219.10	.....	260.73
Cost factors per 100 lb. milk:								
Concentrates	38.1	.76	28.9	.62	30.4	.67	32.0	.70
Succulent feed	136.8	.41	149.9	.42	112.7	.33	83.3	.24
Dry roughage	51.9	.34	42.3	.27	41.5	.30	40.4	.28
Pasture	.....	.21	.....	.17	.....	.13	.....	.11
Total feed and pasture	.....	1.72	.....	1.48	.....	1.43	.....	1.33
Labor	2.7 hr.	.69	2.4 hr.	.63	2.0 hr.	.56	1.7 hr.	.51
Other costs*	.....	.88	.....	.90	.....	.72	.....	.66
Gross cost	.....	3.29	.....	3.01	.....	2.71	.....	2.50
Credits	.....	.21	.....	.24	.....	.19	.....	.21
Net cost*	.....	3.08	.....	2.77	.....	2.52	.....	2.29

*Excluding milk hauling.
†Average price 1920-1924, $2.67 per cwt.

Here are shown quantities of feeds and hours of labor per cow, together with the value of these and all the other cost factors in each of the production groups. As production increased the amount and value of feeds increased. Production increased at a faster rate than feed cost, as shown in Figure 2.

The table also shows that feed cost per hundred pounds of milk was $1.72 in the group producing less than 6,000 pounds of milk, and only $1.33 in the group producing more than 9,000 pounds annually. This is due to the fact that a cow requires a certain amount of feed to maintain her body and develop a calf regardless of the amount of milk produced. It is the feed which she gets in excess of this maintenance requirement that influences her production of milk. Not taking into account the nutrients obtained from pasture, the cows in the class of less than 6,000 pounds annually received feed containing 3,626 pounds of digestible carbohydrates and 442 pounds of digestible protein and have a nutritive ratio of 1:8.2. Those producing more than 9,000 pounds of milk per year received feed containing 4,903 pounds of digestible carbohydrates and 697 pounds of digestible protein, with a nutritive ratio of 1:7.0. The group producing 6,000 to 7,500 pounds of milk annually received a little less grain and hay than the low producing group, but this deficiency was more than made up in the increased feeding of silage and other succulent feed. Annual feed cost in the highest producing group amounted to $130.33 per cow, or $39.65 per cow more than the feed cost for the lowest producing group. While there was an increase of about 44 percent in the feed cost per cow, there was an increase of nearly 85 percent in the annual production per cow. In other words, this additional $39.65 worth of feed was accompanied by an increased milk production valued at $119.51, or a gross return of more than $3 for each additional dollar's worth of feed. This discussion indicates clearly the economy of liberal feeding.

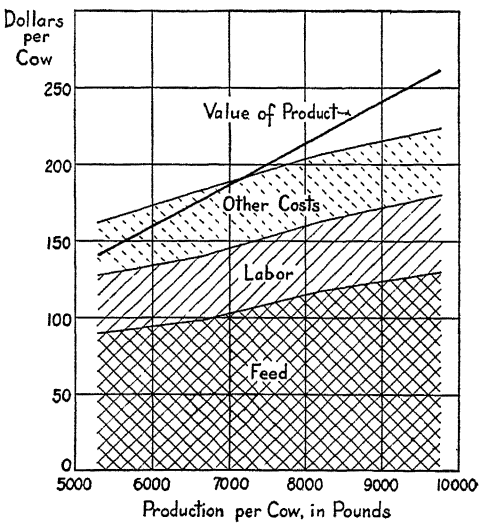

Fig. 2.—Relation of production per cow to costs and returns, 1920-1924

Labor expenditure per cow increased as production increased but not at as fast a rate. In the low producing group 2.7 hours and in the high producing group 1.7 hours were spent per hundred pounds of milk. This was due to the fact that many of the operations took a rather fixed amount of time regardless of production. It does not take 100 percent more time to double the amount of grain or silage fed per cow, nor does it take as long to milk ten cows each giving 20 pounds of milk at a milking as it does to milk 20 cows averaging only 10 pounds.

The costs per cow other than feed and labor ran higher in the high producing herds. One would expect that the better cows would receive better care, that they would be found on farms where the buildings are better and where overhead charges are higher, that they would receive more bedding, that they would be higher priced cows and so would have a higher charge for interest and taxes, and that more would be spent on them for veterinary expense and cow testing. These miscellaneous costs per cow for the low and high producing herds are itemized, with the expenditure for the group producing less than 6,000 pounds given first, followed by the corresponding item for the group producing more than 9,000 pounds, as follows: salt $0.28 and $0.42; straw bedding 1,486 pounds $3.99 and 2,101 pounds $5.38; building charge $4.38 and $6.38; equipment charges $7.97 and $8.80; interest on cows $4.34 and $7.20; taxes and insurance $1.47 and $2.08; depreciation on cows $8.83 and $10.75; bull service $5.20 and $8.24; veterinary expense $0.46 and $0.87; cow testing $0.28 and $2.59; horse labor $1.90 and $1.50; and overhead $7.58 and $10.04, or a total of $46.68 and $64.25 per cow per year. Credits other than milk were higher in the high producing group. Having received more feed the cows produced manure having a higher value. Born of higher producing dams, the calves on these farms had a higher average value at birth.

The data on returns from milk indicate that, under conditions then prevailing, cows producing less than 7,500 pounds of milk per year were not returning their owners very large wages for labor. On the basis of an average selling price of $2.67 per hundred for milk, the average cow in herds producing less than 6,000 pounds failed by $21.67 of breaking even, when all costs were charged against her, while those in herds producing more than 9,000 pounds made a profit, over all costs including labor, amounting to $36.96 per cow. Figures are also presented showing the average labor income made on the various groups of farms. In an area where nearly one-

half of the receipts are derived from the sale of dairy products it is to be expected that there should be such a close correlation between production per cow and labor income.

To emphasize further the importance of high producing cows the following problem is presented: Under conditions of prices for feed, labor, and milk prevalent at the time these records were secured, let us suppose that a certain farm has barn facilities for accommodating a herd of 22 cows. Now let us suppose these cows and the manner in which they are handled fit the conditions as found in the low producing group in Table 14. These 22 cows will then consume $2,000 worth of feed and pasture. They will produce a total of 116,358 pounds of milk, which will lack $477 of paying for the feed, labor, and other costs of keeping the cows.

Let us now suppose that the poorest cows are weeded out and that better cows are secured so that by better feeding their production is raised to the standard of those in the high producing group in Table 14. Two thousand dollars worth of feed will be more than enough to feed 15 cows of this class. The smaller herd of 15 well-fed cows will produce a total of 146,475 pounds of milk in a year, or 26 percent more milk than the herd of 22 poorly fed, low producing cows, altho both herds have the same total feed cost. They do not get the same total quantities of each kind of feed, however. The smaller herd of high producing cows will require a smaller total supply of corn, silage, and pasture, more oats, oil meal and cottonseed meal and practically the same total quantities of all other feeds. The high producing herd will require more labor per cow but only 82 percent as much total labor as the larger herd of low producers. We are assuming that there would be no reduction in total building or equipment charges for the smaller herd. After making all calculations we find that the smaller herd returns $510 over and above all costs. In other words this herd of 15 cows is $987 more profitable than the herd of low producing cows, having yielded milk worth $804 more and incurred costs aggregating $183 less than the herd of 22 cows.

This should not be taken as an argument that the small herd can be handled more economically than the larger one. When the number of cows in the herd is reduced to around five, full employment is not provided for the labor that may be available; labor input, building and equipment charges, and overhead costs per cow are increased, and the total business done, even with extraordinary cows, can not be expected to approach that of a more efficient sized herd, annually producing around 10,000 pounds of milk per cow.

SEASON OF FRESHENING

There is an opinion among many dairymen that cows freshening in the spring and giving their maximum flow of milk during the pasture season will produce milk at a lower cost than those freshening at other seasons of the year. These seventy 1-year records were divided into three groups, based on percentage of cows freshening in the spring of the year, as shown in Table 15. The cows in herds that had the smallest percentage of spring freshening and a large amount of fall freshening were fed the largest amounts of feed. They also received the largest number of hours of labor.

TABLE 15.—Spring Freshening as Related to Cost of Milk Production, by Groups of Farms, 1920-1924

Item	Percent of cows freshening in March, April and May					
	Under 25		25 to 35		35 and over	
Number of farm records	25		21		24	
Number of cow-years	264.3		227.5		321.1	
Cows spring freshening, percent	15.2		29.7		45.9	
Cows fall freshening,* percent	47.9		36.7		27.7	
Cost factors per cow:	*Lb.*	*Dol.*	*Lb.*	*Dol.*	*Lb.*	*Dol.*
Concentrates	2,737	56.90	2,359	52.13	2,066	43.17
Succulent feed	8,474	24.70	8,035	23.59	9,180	26.70
Dry roughage	3,363	23.20	3,034	21.48	3,203	20.90
Pasture	.....	10.66	.....	11.31	.....	10.53
Total feed and pasture	.....	115.46	.....	108.51	.....	101.30
Labor	167 hr.	45.83	150 hr.	40.06	159 hr.	43.66
Other costs	.....	59.66	.....	58.14	.....	53.75
Total gross cost	.....	220.95	.....	206.71	.....	198.71
Credits	.....	19.65	.....	15.07	.....	13.58
Net cost	.....	201.30	.....	191.64	.....	185.13
Production per cow, pounds	.....	8,154	.....	7,289	.....	6,822
Cost per 100 pounds of milk	.....	$2.47	.....	$2.63	.....	$2.71

*September to December, inclusive.

Herds in which most of the cows freshened in the spring had the lowest average cost per cow, but they produced only 6,822 pounds of milk annually at a cost of $2.71 per hundred; while herds in which most of the cows freshened in the fall produced an average of 8,154 pounds of milk per cow at an average cost of $2.47 per hundred. Farmers with a majority of their cows freshening in the fall have the further advantages of having a larger supply of milk to sell during the season when it is highest in price and also more work on their livestock at a time when work on crops is slack. After deducting all costs other than labor from the value of milk produced by these three groups it is found that the farmers with herds freshening principally in the fall received 37.8 cents an hour for all labor expended on the dairy enterprise, while those whose cows freshened principally in the spring received 24.7 cents an hour.

Cows freshening in the early fall give their maximum production during the winter and, if they have been well fed during the winter, are still up to a fairly high level of production at the beginning of the spring pasture season. The change to grass stimulates and increases production so that the cow has a longer lactation period and a higher total production. When cows freshen in the spring they are likely to be turned on grass without any other feed. Their production declines with the hot weather, flies, and dry pastures of August and it is then costly and difficult to bring their production back again during the fall and winter. This accounts for the difference commonly found in the production of these two types of dairying.

The reason that some dairymen hold to the false notion that spring freshening cows produce the cheapest milk is that the milk produced during the pasture season does have a very low cost per hundred when only the values of feed and pasture consumed during the summer and the smaller amounts of labor expended are considered. They forget that their cows are carried thru the winter at a very low level of production and that it is the year-round cost that is important in the end. Very few, if any, dairymen sell all their cows in the fall and buy fresh ones in the spring. Separate costs of production for the stabling period and for the pasture period were not computed. The cost of carrying dry cows thru the winter should be considered as part of the cost of producing milk in the summer, altho this consideration has sometimes been overlooked in cost studies. Even if it were possible to compute separate costs for milk produced during different seasons of the year, the figures would be of little practical value. After all, the dairyman should not be interested merely in the cost of producing winter milk or summer milk, but in the difference in effectiveness of the system wherein most of the cows freshen in the fall, have a fairly uniform production thruout the year, and a high average production per cow, and the other system of spring freshening with its accompanying uneven flow of milk and low annual production per cow.

UNIFORMITY OF PRODUCTION

In order to show whether the dairyman who manages his herd so as to produce a fairly uniform flow of milk thruout the year gains anything for his efforts, these records were divided into four groups based on the uniformity of production as shown in Table 16. Three farms were omitted in this calculation; two of these sold cream and the other one was just beginning in the dairy business, starting in 1923 with 2 cows and ending the year 1924 with a herd of 13 cows.

The manner of this classification can be made clear by an example: Suppose the average milk production on a given farm for the entire year is 10,000 pounds per month. During some months it may run 2,000 pounds over or under this monthly average production. Suppose the 12 variations from this average monthly production when added together, regardless of whether the supply is more or less than the average, give a total of 18,600, or an average monthly deviation of 1,550 pounds. This divided by the 10,000 pounds gives 15.5 percent, the average deviation from the average monthly production on this farm.

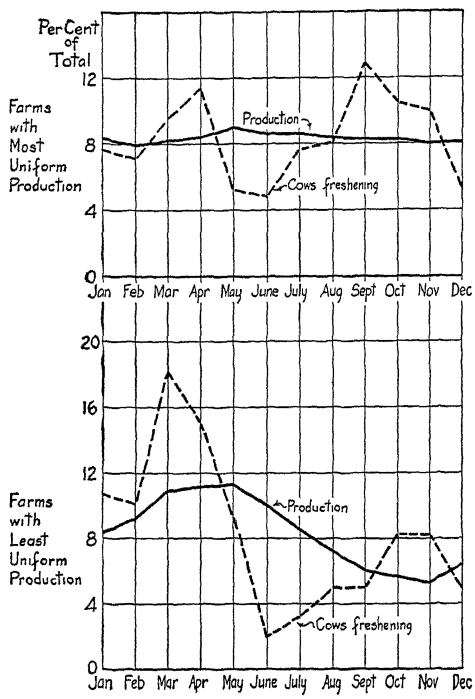

Fig. 3.—Percentage of cows freshening and of total milk produced by herds each month on two groups of farms, one having the most uniform production thruout the year, the other the least uniform.

The table shows that on the farms with the most uniform production 26.1 percent of the cows freshened in the spring, while on those farms with the most uneven production, 42.7 percent freshened in the spring. The percentage of cows freshening and percentage of total milk produced each month on these two extreme groups of farms are shown graphically in Figure 3.

The other outstanding fact in Table 16 is that a steady flow of milk can be secured at a low cost. The average annual production of the cows on the farms that had the most uniform supply of milk was nearly 1,300 pounds more than that of the cows on the farms that had the most uneven supply. Farm 2 was in this steady group four out of five years, Farm 6 three out of five years, Farm 14 two out of three years, and Farm 17 the two years and Farm 23 the one year in which they kept records. These were all low-cost producers. (See Table 8). Farms 2 and 6 maintained a fairly even production by the purchase of fresh cows to take the place of those which became dry. It is

more difficult for the dairy farmer who raises his own heifers to produce a uniform milk supply than it is for the one who replaces his herd by purchase, since the one who buys can readily replace the cows that are drying off with fresh ones, while the other farmer must pay more attention to season of freshening and intensity of feeding.

TABLE 16.—Uniformity of Milk Production as Related to Cost of Production, by Groups of Farms, 1920-1924

Item	Percent of deviation from average monthly production							
	Under 12		12 to 18		18 to 24		24 and over	
Number of farm records	17		13		15		14	
Number of cow-years	231.1		164.9		168.6		161.9	
Cows freshening, March, April, May, percent	26.1		30.3		33.4		42.7	
Cost factors per cow:	*Lb.*	*Dol.*	*Lb.*	*Dol.*	*Lb.*	*Dol.*	*Lb.*	*Dol.*
Concentrates	2251	47.48	2353	47.42	2559	56.83	2116	45.21
Succulent feed	7826	22.23	8679	25.00	9287	27.00	10173	30.81
Dry roughage	3147	20.45	2896	19.44	3140	24.25	3571	24.01
Pasture	.....	11.28	.....	10.39	.....	11.30	.....	9.81
Total feed and pasture	.....	101.44	.....	102.25	.....	119.38	.....	109.84
Labor	146 hr.	39.88	173 hr.	48.06	160 hr.	41.40	164 hr.	45.39
Other costs	.....	51.07	.....	52.28	.....	56.94	.....	57.98
Total gross cost	.....	192.39	.....	202.59	.....	217.72	.....	213.21
Credits other than milk	.....	13.64	.....	13.75	.....	15.32	.....	13.31
Net cost of milk	.....	178.75	.....	188.84	.....	202.40	.....	199.90
Production per cow, pounds	.....	7741	.....	7181	.....	7282	.....	6456
Cost per 100 pounds of milk	.....	$2.31	.....	$2.63	.....	$2.78	.....	$3.10

It is reasonable to expect that where a large percent of the annual supply of milk is sold in the four or five months of low prices, the average price for the year will be lower than where a steady supply is produced.

TABLE 17.—Effect of Seasonal Variation in Production on Average Selling Price of Milk Sold by 3 Farms, 1924

Item	Farm 17	Farm 2	Farm 5
Total production, in pounds per month:			
January	13,309	9,506	4,077
February	11,574	8,095	5,579
March	10,660	8,820	7,793
April	10,798	8,933	7,360
May	11,088	10,911	9,513
June	10,085	10,304	8,121
July	10,111	9,107	7,758
August	11,566	9,108	6,459
September	11,081	8,823	5,025
October	12,196	9,258	4,219
November	12,528	7,411	2,951
December	13,080	6,483	1,874
Average per month	11,506	8,980	5,894
Average selling price, per hundredweight	$2.39	$2.34	$2.27

The milk production by months on three farms in the year 1924, is given in Table 17 and is shown graphically in Figure 4. Farms 17 and 2 were in the group having the most uniform production, while Farm 5 was in the group having the most fluctuation. The production on Farms 17 and 2 did not differ greatly in uniformity, yet the milk on Farm 17 brought an average farm price of $2.39 per hundred pounds of 3.5 milk, while that on Farm 2 brought an average of $2.34. The difference was due to the fact that a larger percentage of the milk on Farm 17 was sold in the winter when prices were high; and on Farm 2, in the months of May and June when prices were low. The production on Farm 5 increased from 4,077 pounds in January, 1924 to a peak of 9,513 pounds in May and then fell to a low point of 1,874 pounds in December. The average selling price of milk on this farm was $2.27 per hundred in 1924, 7 cents less than the price on Farm 2 and 12 cents less than on Farm 17.

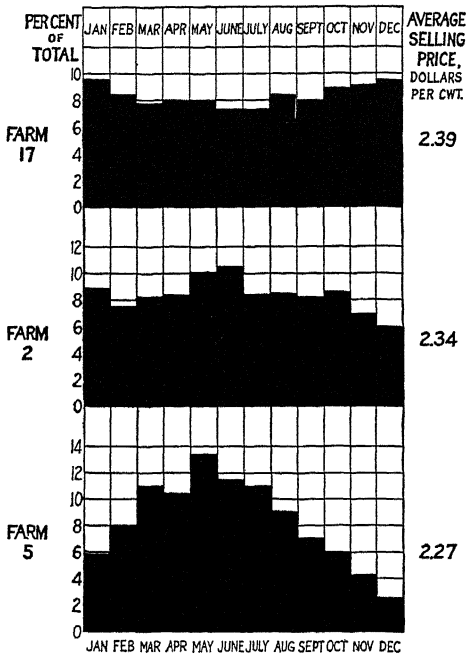

Fig. 4.—Milk production on three farms in 1924 and the average selling price received by each

CHANGES IN SIZE AND INTENSITY OF THE ENTERPRISE

The changes which dairymen make in the handling of their herds under varying market conditions is indicated in Table 18, which shows several factors on the same seven farms for a period of five years.

In 1920 costs of production were high, and altho milk was bringing a fairly high price, production per cow was only 6,669 pounds. Costs fell in 1921 but not as far in proportion as the price of milk. Accompanying this drop in profits from dairying five of the seven dairymen reduced the number of cows below their

average for the year 1920, and there was also a general decrease in production per cow. Total milk production per farm during the five years was lowest in 1921.

TABLE 18.—Dairy Profits as Related to Various Herd Management Factors, Average of 7 Farms by Years, 1920-1924

Item	1920	1921	1922	1923	1924
Cost of producing milk, dollars per cwt.	3.29	2.56	2.06	2.09	2.55
Selling price of milk, dollars per cwt.	3.55	2.61	2.14	2.69	2.38
Profit or loss on milk, dollars per cwt.	.26	.05	.08	.60	—.17
Ratio selling price to cost, percent	107.9	102.0	103.9	128.7	93.3
Milk production per cow, pound	6,669	6,558	7,285	7,884	7,697
Farms increasing production per cow over previous year, number	.....	2	6	7	1
Farms decreasing production per cow, number	....	5	1	0	6
Cows per farm, number	10.8	10.1	9.8	10.4	9.5
Farms increasing number of cows over previous year, number	.....	2	3	6	2
Farms decreasing number of cows, number	.....	5	4	1	5
Milk production per farm, pounds	71,909	66,347	71,447	82,105	72,914
Heifers per farm, yearling and over, at beginning of year, number	3.3	1.4	1.3	1.0	.7
Heifers per farm at end of year, number	1.4	1.3	1.0	.7	2.0

In 1922 dairying was just a little more profitable, even tho milk prices reached their lowest point. On six of the seven farms there was an increase in production per cow. Costs in 1923 were about on a par with 1922 but milk prices were decidedly better. Along with this improvement all of the dairymen increased their production per cow over the previous year and on six of the farms the number of cows was increased. Total production per farm and total dairy profits were higher in 1923 than in any other year.

In the summer of 1924 milk prices took a precipitous drop, resulting in a low average price for that year; feed prices for home-grown feeds were higher; silage and corn yields were very poor that fall; and, altogether it was an unprofitable year for dairymen in that section. Accompanying these conditions, six of the farms had a lower production per cow and on five of the seven the number of cows was reduced.

In January 1920 there was an average of 3.3 heifers, 1 year old or over, per farm on these seven farms. This large number in proportion to the number of cows, was a natural result of the high milk prices of 1918 and 1919. Following these years there was not much incentive to save heifer calves until the year 1923. In January 1924 there were only five heifers over 1 year of age on all seven farms. Heifer calves were being saved, however, in 1923 as shown by the fact that there was an average of two heifers per farm at the close of 1924.

YOUNG DAIRY CATTLE

Practically all of the young dairy cattle kept beyond the veal-calf age were intended for additions to the herd or raised for sale as young breeding stock. The usual practice was to wean the calves at birth or as soon as the milk was ready for human use. Most of the calves that were kept were then pail-fed, principally on whole milk, there being very little skimmilk available on farms selling whole milk. The total value of skimmilk and whole milk, the latter at an average of about 85 percent of the farm selling price, amounted to nearly 30 percent of the total value of the feed and pasture consumed by all the young stock.

TABLE 19.—Young Cattle: Profit and Loss Summary of 20 Farms, 1920-1924*

Item	Total number	Total value		Value per head
Debits:				
Calves in beginning inventory	60	$ 2,168.00		$ 36.13
Calves purchased	20	250.50		12.52
Calves born, alive	616	5,549.00		9.00
Yearling heifers in beginning inventory	56	3,945.00		70.45
Yearling heifers purchased	9	490.63		54.51
2-year old heifers in beginning inventory	17	1,360.00		80.00
2-year old heifers purchased	10	920.00		92.00
Costs of keeping all young stock:				
Feed and pasture		16,939.12		
Labor		3,992.27		
Other costs		6,013.49		
Total	788		$41,682.01	
Credits:				
Calves in closing inventory	66	$ 2,250.00		34.09
Calves sold	493	7,183.23		14.57
Calves butchered	2	66.88		33.44
Calf hides sold		7.20		
Bull calves kept to yearling age	9	780.00		86.67
Yearling heifers in closing inventory	51	3,045.00		59.70
Heifers butchered	2	97.66		48.83
Heifers sold	34	2,946.85		86.67
Heifers freshened	114	12,785.00		112.15
2-year old heifers in closing inventory	17	1,615.00		95.00
Manure produced		1,483.80		
Fair premiums and other receipts		156.51		
Total	788		32,417.13	
Debits over credits, total			$ 9,210.88	
Debits over credits, annual per farm*		$131.58		

*A total of 70 farm-year records are represented.

A profit and loss summary of all young stock on farms for which milk costs were computed is given in Table 19. This shows that out of a total of 696 calves born, bought, and inventoried there were 493, or 71 percent of the total, sold as calves. Of this number only 35 were sold as purebred bull or heifer calves for breeding purposes, the others being disposed of as very young veal calves.

Of the 114 heifers that freshened during the period covered by these records, 76 were on hand in the beginning inventories as calves and heifers, 25 were born, and only 13 were purchased.

Thus these farmers were depending principally on calves of their own raising to supply their heifers. In Table 11 it was shown that heifers replaced only about one-half of the cows that were disposed of, the number of cows purchased being practically the same as the number of heifers freshening.

In Table 19 the values of young stock in the first inventory of each farm, the value of living calves dropped, and the value of the relatively few calves and heifers purchased are added to the costs of keeping all the young stock. Feed and pasture formed 63 percent of the costs of keeping young stock; labor 15 percent; and all other costs, including building and equipment charges, bedding, horse labor, interest, taxes, insurance, registration, advertising, veterinary expense, and a share of overhead costs made up 22 percent of the total. From the total debits was subtracted the sum of the values of all young stock sold and butchered, the value of heifers freshened and of yearling bulls kept, the value of all young stock in the closing inventories, and the miscellaneous credits such as manure and fair premiums. The table shows that the costs on young stock exceeded the credits by $131.58 per farm annually.

It might appear from this that the young cattle enterprise was an unprofitable one. It should be borne in mind that most of these costs in Table 19 are not cash-out-of-the-pocket costs, and that the farm operator does not have to receive 30 cents an hour for the work done on every enterprise in order to continue with that enterprise. In fact, an apparently unprofitable line may add something to the year's income and for that reason be justifiable. It might be difficult to prove that these farmers would have made larger incomes if they had replaced all of their cows by purchase instead of raising half the number that were replaced. The danger of introducing disease into the herd is increased by buying cows. And when purchasing cows the farmer generally has to base his judgment as to the cow's ability as a milk producer upon her conformation, which may sometimes be very misleading.

COST OF KEEPING HERD BULLS

Eleven of the farms kept a herd bull all of the time; five farms had either a part interest in a bull or kept one part of the time; the remaining four farms had no herd bull.

FEED PER BULL

Table 20 shows the cost of feed and the quantities consumed per bull. The average value of their feed and pasture was about 28 percent less than the average for the cows.

TABLE 20.—Annual Feed Cost and Quantities of Feed Consumed per Bull, by Farms, 1920-1924

Farm No.	Annual feed consumption per bull											
	Total feed and pasture	Concentrates						Silage, etc.	Dry roughage			Pasture
		Corn	Oats	Oil-meal*	Bran	Other	Total		Hay	Stover	Total	
	Dol.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Days*
17	40.45	120	432	0	0	0	552	1,257	2,383	975	3,358	145
1	41.90	639	414	209	22	133	1,417	1,128	1,801	900	2,701	0
13	46.67	0	0	0	0	753	753	4,260	3,330	523	3,853	60
12	61.12	290	331	339	120	165	1,245	3,203	3,760	353	4,113	16
3	62.44	467	199	44	8	0	718	4,667	4,499	592	5,091	23
10	73.84	252	474	366	227	16	1,335	2,820	3,476	676	4,152	53
11	76.19	645	525	300	182	8	1,660	1,803	5,757	975	6,732	20
5	82.53	1,194	736	155	320	24	2,429	816	3,080	1,558	4,638	24
22	84.24	427	285	379	12	228	1,331	4,289	3,366	0	3,366	82
15	88.90	188	300	0	0	0	488	900	5,816	0	5,816	0
8	89.76	340	567	106	14	687	1,714	11,392	2,349	445	2,794	16
18	91.04	556	813	309	273	874	2,825	1,384	4,906	1,159	6,065	0
2	91.07	1,902	558	56	0	0	2,516	715	4,301	237	4,538	49
14	94.17	1,190	249	0	0	0	1,440	0	7,301	0	7,301	0
4	95.31	738	525	181	0	66	1,510	3,182	2,518	0	2,518	165
20	130.98	806	998	350	109	236	2,499	2,107	6,042	383	6,425	0
Av.	78.38	625	464	194	90	214	1,587	3,405	3,935	526	4,461	41

*Includes cottonseed meal and linseed meal.

They got less grain, containing a larger proportion of corn and a smaller proportion of purchased concentrates, than was fed to cows. The amount of silage was also considerably less, no doubt due to the fact that there is a general opinion among dairymen that feeding more than 10 or 15 pounds of silage per day impairs the bulls breeding powers. As a general thing the bulls were not allowed to run on pasture with the herd. On five of the farms the bulls received no pasture at all, in part because the fences were inadequate and also because some of the bulls were unruly. The orchard or separate paddock near the barn provided most of the pasture. The short time that they were on pasture, as compared to cows, and the smaller amount of silage fed, account for the greater amount of hay consumed during the year.

TOTAL COST PER BULL

The total cost of keeping a bull on these farms is shown in Table 21. After subtracting credits for manure produced and cash receipts for service the net cost of keeping a bull varied from $66.73 to $192.03 a year, with and average of $124.33. The amount of man labor expended per bull varied from 48 to 191 hours a year. Farms 4, 17, and 22, with bulls out on pasture the longest time, spent the smallest number of hours per bull.

TABLE 21.—Variations in Yearly Cost of Keeping a Bull, by Farms, 1920-1924

Farm	Annual cost per bull															
	Feed	Pasture	Bedding	Man labor		Horse work	Building charge	Equipment charge	Interest on bull	Taxes, insurance	Depreciation	Gross cost	Credits			Net cost
				Amt.	Value								Service	Manure	Total	
	Dol.	*Dol.*	*Dol.*	*Hr.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*
17	30.70	9.75	5.94	48.2	14.94	0.10	3.42	1.71	3.60	1.07	10.00	81.23	5.50	9.00	14.50	66.73
1	41.90	.....	7.50	63.0	18.14	.....	2.25	3.53	3.30	1 21	.....	77.83	.....	9.00	9.00	68.83
12	60.07	1.05	1.53	89.4	26.50	.....	5.31	1.08	5.15	1.80	7.35	109.84	19.16	10.09	29.25	80.59
13	41.84	4.83	3.37	64.0	18.29	.....	5.53	5.19	9.71	1.72	11.63	102.11	.....	10.66	10.66	91.45
3	61.12	1.32	5.81	105.1	26.99	.54	1.86	1.06	5.47	1.76	25.08	131.01	6.58	9.21	15.79	115.22
15	83.90	.....	2.50	74.5	22.30	.48	5.64	5.74	3.90	1.10	.....	130.56	.....	11.00	11.00	119.56
8	88.71	1.05	5.07	102.0	22.80	.45	5.46	6.02	4.27	1.37	2.25	137.45	4.89	11.25	16.14	121.31
2	88.42	2.65	2.77	107.7	26.70	.64	4.52	1.75	5.17	2.34	5.00	139.96	7.20	9.20	16.40	123.56
5	80.16	2.37	6.10	100.7	30.16	1.32	2.89	2.09	8.21	2.34	13.68	149.32	3.68	9.58	13.26	136.06
10	69.60	4.24	3.36	104.1	28.41	.07	7.48	12.76	30.65	6.02	25.40	187.99	38.65	10.61	49.26	138.73
14	94.17	.....	3.05	101.4	30.36	.53	3 93	2.44	6.04	1.03	31.80	173.35	25.08	7.43	32.51	140.84
22	77.74	6.50	3.37	60.5	16.51	.81	8.82	4.68	7.50	1.66	25.00	152.59	....	8.25	8.25	144.34
11	74.52	1.67	2.27	191.3	40.27	.35	9.07	6.78	10.25	2.28	25.17	172.63	16.67	10.08	26.75	145.88
4	83.79	11.52	3.35	55.4	13.87	.70	3.68	3.09	5.49	2.08	26.52	154.09	....	5.63	5.63	148.46
18	91.04	.....	5.90	138.7	41.21	.28	8.76	11.29	12.10	2.19	9.89	182.66	6.44	9.34	15.77	166.89
20	130.98	.....	4.13	134.9	39.58	.90	2.36	1.14	11.40	3.79	10.00	204.28	.....	12.25	12.25	192.03
Av.	75.54	2.84	3.78*	100.9	26.71	.39	5.39	4.86	9.79	2.43	14.67	146.40	12.35	9.72	22.07	124.33†

*An average of 1,435 pounds of straw per bull annually.

†The annual herd bull cost per cow was $7.32, there being an average of 17 cows per bull on these farms.

The farms which kept herd bulls continuously had herds averaging 14.4 cows, or 12.4 cows per bull. Net cost of service averaged $10.11 per cow on these farms. Those having a bull part of the time had herds averaging 10.6 cows. Their herd bull cost amounted to $4.22 per cow, with additional hired service averaging 77 cents per cow. Those without a herd bull had only 6.2 cows per farm, undoubtedly too small a herd to justify keeping a bull. Their annual cash cost of hired service averaged only $1.25 per cow.

The question of whether the keeping of a bull is warranted is one the farmer has to decide, weighing on one side the cost of keeping a bull, and on the other the inconvenience of not having one, the risk of getting contagious abortion in the herd, the inability to build up his herd if he must depend upon a neighbor's grade bull for service, and perhaps the inability to obtain service nearby at a reasonable cost.

OTHER LIVESTOCK ENTERPRISE COSTS

POULTRY COSTS

Poultry was second in importance among the livestock enterprises on these farms, yielding 10.5 percent of the total farm receipts. The average mature flock consisted of a year-round average of 116 hens and 7 roosters. After adding to this one-half the number of pullets and cockerels raised to maturity and one-third to one-fourth the number of broilers and fries sold or eaten, the average flock was computed to have the equivalent of a total of 188 mature birds.

Egg production per hen averaged 92 eggs a year, which is about 30 percent above the average of the State. Cleveland provides a good market for poultry and eggs, but farmers in this section were handicapped by high grain prices. The value of eggs produced per farm, not including those used for hatching, amounted to $342.39 a year; net increase in poultry (poultry sold and eaten, plus increase in inventory, and minus poultry and chicks purchased) amounted to a yearly average of $118.47 per farm.

FARM-TO-FORM VARIATIONS

In Table 22 are shown the costs of the various items entering into the annual cost of keeping a flock of 100 chickens on the different farms. The total net cost averaged $219.92 and the total returns $245.42, leaving a net annual return over all costs amounting to $25.50 per 100 chickens.

Eight of the twenty-three farms failed to break even on their poultry enterprise. Their flocks were small and were regarded of minor importance, producing less than 4 percent of their total farm

TABLE 22.—Poultry: Variations in Items of Annual Cost and Returns per 100 Chickens, by Farms, 1920-1924

Farm	Average size of flock*	Annual cost per 100 chickens*												Annual returns per 100 chickens	
		Feed	Labor		Horse work	Building charge	Equipment charge	Interest	Taxes, insurance	Miscellaneous†	Overhead	Total	Manure credit	Net cost of meat and eggs	Total‡	Above cost
			Amount	Value												
	No.	*Dol.*	*Hr.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*
1	220	134.30	181.8	50.31	2.73	21.25	8.76	5.80	2.13	2.43	16.40	244.11	9.54	234.57	349.68	115.11
14	137	96.76	122.9	36.77	.57	8.50	1.95	5.15	.94	.77	13.27	164.68	9.71	154.97	246.45	91.48
10	166	179.47	206 6	57.98	.82	23.78	15.47	5.90	1.56	1.89	20.84	307.71	11.61	296.10	376.80	80.70
13	266	76.87	151.3	44.08	1.10	7.31	10.92	3.70	.84	.70	13.17	158.69	9.89	148.80	222.15	73.35
5	130	135.76	103.5	30.95	.78	7.76	.94	4.46	1.40	.....	14.21	196.26	10.34	185.92	248.25	62.33
17	289	111.13	159.5	50.04	.16	15.97	.19	4.05	1.68	1.04	7.81	192.07	8.67	183.40	244.95	61.55
3	112	129.60	227.6	58.49	.34	7.41	3.54	4.81	2.01	3.31	13.12	222.63	10.91	211.72	267.39	55.67
23	268	110.41	243.6	73.10	4.47	17.87	8.79	3.91	1.52	2.61	14.95	237.63	10.82	226.81	281.73	54.92
8	170	85.41	133.2	29.83	.07	15.46	10.91	4.84	1.43	.97	9.95	158.87	9.72	149.15	199.47	50.32
11	128	75.00	183.5	39.54	.35	11.10	15.15	5.29	1.25	.90	11.36	159.94	8.31	151.63	190.72	39.09
19	1,312	209.14	251.8	68.57	7.68	13.12	12.48	7.39	1.51	3.31	5.26	328.46	7.62	320.84	328.68	7.84
22	117	187.92	197.0	53.71	.13	10.67	4.51	4.47	.79	4.11	15.78	282.09	11.54	270.55	275.61	5.06
9	187	103.58	155.1	45.98	1.03	4.00	1.19	3.79	2.02	.....	8.76	170.35	11.24	159.11	163.34	4.23
16	363	131.11	190.1	55.66	3.38	8.71	6.93	2.87	.83	1.71	10.72	221.92	10.45	211.47	211.94	.47
7	280	125.32	275.2	81.57	5.55	8.63	3.20	5.26	1.33	2.07	12.87	245.80	8.85	236.95	237.04	.09
6	68	86.62	154.7	46.55	.40	15.80	.11	3.79	1.13	.44	4.54	159.38	7.92	151.46	142.30	—9.16
20	28	105.98	283.5	83.41	.....	22.59	.....	5.09	1.68	.....	6.95	225.70	9.09	216.61	195.38	—21.23
2	100	107.20	259.2	64.44	.62	12.48	1.94	5.08	2.60	.06	9.66	204.08	8.83	195.25	171.82	—23.43
18	166	118.34	150.4	44.74	.36	11.73	9.97	4.24	.76	1.65	8.67	200.46	9.91	190.55	163.76	—26.79
21	40	125.23	197.8	60.22	3.42	21.29	2.91	7.51	4.20	.....	8 64	233.42	11.11	222.31	186.30	—36.01
12	149	129.70	216.8	64.53	.41	20.00	9.70	3.80	1.49	.71	8.71	239 05	10.27	228.78	172.93	—55.85
4	119	74.22	202.2	51.36	.74	10.14	.39	4.88	.87	.88	5.03	148.51	6.06	142.45	86.10	—56.35
15	105	115.69	162.2	47.83	.36	8.59	2.17	4.93	1.25	.....	9.44	190.26	9.87	180.39	110.73	—69.66
Av.	188	132.48	199.5	55.53	2.70	12.52	7.07	5.15	1.48	1.67	10.63	229.23	9.31	219.92	245.42	25.50

*Size of flock computed by adding together the yearly average number of mature hens and roosters, one-half the number of pullets and cockerels raised to maturity, and one-fourth to one-third the number of young chickens sold or used in the farm household.

†Includes fuel for incubators and brooder stoves, disinfectants, and medicines.

‡Total returns include sales and home use of poultry and eggs, plus any increase in inventory, less purchases of poultry and hatching eggs.

income. They had an average of 66 hens, and their average production per hen was 55 eggs, bringing 32 cents a dozen. The fifteen farms with profitable poultry had an average of 143 hens. Production per hen averaged 100 eggs, selling at 39 cents a dozen.

Labor varied on the different farms from 103 to 283 hours per 100 chickens. There seems to be little or no correlation between size of flock and amount of time spent per 100 birds. Some of the large flocks received more labor per bird than some of the very small flocks. There was a relationship between egg production per hen and amount of labor, as will be explained later.

RETURNS ABOVE COST OF FEED

Average quantities of feeds consumed annually per 100 mature fowls or their equivalent are shown in Table 24. The amounts which the flock foraged about the farmstead and adjoining fields are not included. Table 22 shows that there was a wide variation in the total value of feed consumed per 100 birds, and that there was an even greater variation in the range in returns above feed costs. Farm 1 made an annual return of $215.38 above the cost of feed per 100 fowls, while on Farm 15 the value of feed for 100 chickens exceeded the annual receipts by $4.96.

The farms were grouped into three classes according to return above feed cost. The results of this grouping are shown in Table 23. Farm 19 was omitted on account of the effect which the large number of poultry would have on the weighted average of the several factors.

Farms with the highest returns above feed cost had the largest flocks on the average and got nearly twice as many eggs per hen as the farms with the lowest return above feed cost. The most profitable group had more fall and winter eggs and consequently received a higher average price per dozen for all eggs sold. As the margin of returns above feed cost increased there was an appreciable increase in the amount of feed consumed per 100 chickens and a 33 percent increase in the volume of protein in the feed, so the better paying flocks were getting the narrower rations. These flocks produced not only more eggs but also more meat than did the less profitable flocks.

UNIT COST OF KEEPING 100 CHICKENS

The average quantities of feed and the cost of this feed and the other items entering into the cost of keeping a flock of 100 chickens under conditions such as prevailed during this study are shown in Table 24. It should be understood that these figures pertain to

TABLE 23.—Poultry: Relation of Return Above Feed Cost per 100 Chickens to Other Factors, by Groups of Farms, 1920-1924

Item	Returns above feed cost, per 100 chickens, annually		
	Under $75	$75 to $125	$125 and over
Farms.....No..	8	7	7
Average hens per flock.....No..	74	103	116
Total chickens per farm.....No..	116	179	190
Return over feed cost, per 100 chickens.....Dol..	41.95	105.88	170.33
Annual egg production per hen.....No..	56	93	107
Eggs sold October to January, inclusive.....Pct.	8.2	13.1	22.5
Nutritive ratio of feed, other than range.....Pct.	1:8.4	1:7.2	1:7.0
Per 100 chickens annually:			
Total concentrates fed.....Lb..	5398	5654	5990
Digestible nutrients in feed.....Lb..	4303	4548	4788
Digestible protein in feed.....Lb..	514	628	680
Feed cost.....Dol..	103.80	118.67	122.01
Labor.....Hr..	188.5	194.2	181.5
Labor cost.....Dol..	52.59	54.00	51.47
Total cost.....Dol..	176.68	196.82	210.61
Total returns.....Dol..	145.75	224.55	292.34
Returns above cost.....Dol..	−30.93	27.73	81.73
Eggs produced.....Doz..	296	450	543
Eggs, value.....Dol..	92.88	156.41	202.37
Meat, value.....Dol..	52.87	68.14	89.97
Cost of eggs, per doz.....Dol..	.381	.304	.268
Selling price of eggs, per dozen.....Dol..	.314	.347	.373
Return per hour of labor on poultry.....Dol..	.06	.42	.73
Return per dollar's worth of feed.....Dol..	1.40	1.89	2.40
Cost per dollar of returns from poultry.....Dol..	1.21	.88	.72

TABLE 24.—Poultry: Unit Cost of Keeping a Flock of Poultry Equivalent to 100 Hens for a Year, Average of 23 Farms, 1920-1924

Item of cost	Amount	Value	
		Per unit	Total
Feed:		*Dol.*	*Dol.*
Corn, shelled	2236 lb.	1.99 per cwt.	44.55
Oats	907 lb.	1.82 per cwt.	16.54
Wheat	1824 lb.	2.13 per cwt.	38.94
Buckwheat	64 lb.	1.46 per cwt.	.93
Bran	244 lb.	2.06 per cwt.	5.03
Middlings	98 lb.	2.13 per cwt.	2.09
Tankage, meat scraps	193 lb.	4.44 per cwt.	8.55
Mash and other feeds	311 lb.	2.60 per cwt.	8.10
Total concentrates	5877 lb.	2.12 per cwt.	124.73
Skimmilk	751 lb.	.50 per cwt.	3.75
Green feed	149 lb.	.62 per cwt.	.92
Oyster shell	111 lb.	1.25 per cwt.	1.38
Grit and minerals			1.70
Total feed			132.48
Labor	199.5 hr.	.278 per hr.	55.53
Horse work	11.8 hr.	.229 per hr.	2.70
Building charges			12.52
Equipment charges			7.07
Interest on flock at 5 percent			5.16
Taxes and insurance			1.48
Overhead			10.63
Miscellaneous			1.67
Total annual cost per 100 chickens			229.23
Manure credit			9.31
Net cost of meat and eggs			219.92

TABLE 25.—Poultry: Distribution of Costs of and Returns From Poultry and Egg Production, by Farms, 1920-1924

Farm	Division of receipts		Per 100 chickens, annually								Per dozen eggs		Cost per $1.00 returns from poultry
	Eggs	Poultry	Total cost of eggs and meat	Egg production*		Cost of eggs	Meat production†		Total returns	Returns above cost	Selling price	Cost	
				Amount	Value		Value	Cost					
	Pct.	*Pct.*	*Dol.*	*Doz.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*
14	62.7	37.3	154.97	416.9	154.59	97.17	91 86	57.80	246.45	91.48	0.371	0.233	0.63
1	78.6	21.4	234.57	674.3	274.95	184.37	74.73	50.20	349.68	115.11	.408	.273	.67
13	53.1	46.9	148.80	400.2	118.10	79.01	104.05	69.79	222.15	73.35	.295	.197	.67
5	75.9	24.1	185.92	560.1	188.34	141.11	59.91	44.81	248.25	62.33	.336	.252	.75
17	73.0	27.0	183.40	555.5	178.71	133.88	66.24	49.52	244.95	61.55	.322	.241	.75
8	48.2	51.8	149.15	294.2	96.10	71.89	103.37	77.26	199.47	50.32	.327	.244	.75
10	70.5	29.5	296.10	616.2	265.80	208.75	110.00	87.35	376.80	80.70	.431	.339	.78
3	63.1	36.9	211.72	456.4	168.66	133.60	98.73	78.12	267.39	55.67	.370	.293	.79
23	68.7	31.3	226.81	590.2	193.51	155.82	88.22	70.99	281.73	54.92	.328	.264	.80
11	62.4	37.6	151.63	364.2	118.96	94.62	71.76	57.01	190.72	39.08	.327	.260	.80
9	45.5	54.5	159.11	242.5	74.27	72.40	89.07	86.71	163.34	4.23	.306	.299	.97
19	93.0	7.0	320.84	617.1	305.59	298.38	23.09	22.46	328.68	7.84	.495	.484	.98
22	55.6	44.4	270 55	340.9	153.17	150.43	122.44	120.12	275.61	5.06	.449	.441	.98
16	73.2	26.8	211.47	515.3	155.24	154.79	56.70	56.68	211.94	.47	.301	.300	1.00
7	79.9	20.1	236.95	504.8	189.48	189.32	47.56	47.63	237.04	.09	.375	.375	1.00
6	34.6	65.4	151.46	155.9	49.19	52.41	93.11	99.05	142.30	—9.16	.316	.336	1.06
20	82.6	17.4	216.61	387.5	161.29	178.92	34.09	37.69	195.38	—21.23	.416	.462	1.11
2	67.5	32.5	195.25	347.9	116.07	131.79	55.75	63.46	171.82	—23.43	.334	.379	1.14
18	78.6	21.4	190.55	394.7	128.69	149.77	35.07	40.78	163.76	—26.79	.326	.380	1.16
21	62.4	37.6	222.31	288.9	116 28	138.72	70.02	83.59	186.30	—36.01	.403	.480	1.19
12	82.7	17.3	228.78	503.3	143.00	189.20	29.93	39.58	172.93	—55.85	.284	.376	1.32
15	74.5	25.5	180.39	260.4	82.45	134.39	28.28	46.00	110.73	—69.66	.317	.516	1.63
4	77.1	22.9	142.45	206.5	66.38	109.83	19.72	32.62	86.10	—56.35	.322	.532	1.65
Average	74.3	25.7	219.92	472.4	182.33	163.40	63.09	56.52	245.42	25.50	.386	.346	.90

*Includes eggs sold and used in the household but not farm eggs used for hatching, no record having been kept of this number.
†Includes sales and home use of poultry, plus any increase in inventory, less purchases of poultry.

farms that had an average of 116 hens and 7 roosters, raised about 80 pullets to maturity, and sold or ate about the same number of young cockerels. The average annual production per hen was 92 eggs, excluding those used for hatching, and about three-fourths of the flock income was from eggs.

In other sections where cream is sold, an increased feeding of skimmilk would reduce the amount of grain fed or increase the returns. In most sections of Ohio feed values, per hundred pounds of the different feeds, would have been lower than those indicated here. Feed constituted 57.8 percent of the cost of the poultry enterprise, labor 24.2 percent, and other items 18.0 percent.

Inasmuch as it was impractical to keep the feed, labor, and other costs of the laying flock separate from those of the growing chicks it was necessary to allocate the costs in order to arrive at the approximate cost of producing a dozen eggs. This was done by dividing the costs on the basis of the percent that the receipts from eggs and from meat were of the total poultry receipts. In other words, if 60 percent of the poultry receipts of a certain farm were from eggs it was considered equitable to charge 60 percent of the total poultry flock costs to eggs and 40 percent to meat production.

Table 25 shows the distribution of the poultry costs and returns on the different farms. The cost of producing eggs varied from 19.7 to 53.2 cents per dozen, the average being 34.6 cents. Cost per dollar returns from the poultry enterprise ranged from 63 cents to $1.65, as shown in the column on the extreme right. The farms that failed to make a profit on their poultry had the lowest meat production per hundred birds.

SEASON OF EGG PRODUCTION AS RELATED TO PROFITS

Egg prices are highest in October, November, December, and January. In order to find out whether it was economical to produce eggs at this season of the year these farms were divided into three groups, based on the percentage of the year's eggs sold during these four months of high prices. The results of this grouping are shown in Table 26.

The farms with a large proportion of their annual egg production in October, November, December, and January produced 90 percent more eggs per hen than the farms with a relatively small fall and winter production. The feeding of the fall-laying flocks was more liberal, both in total amount of feed and in protein content, than of the other flocks. Pullets must be well fed during the summer and early fall to start laying in November and they

must be fed liberally to continue laying. It is the amount of feed that a hen receives above her maintenance requirements that largely determines her profit as an egg producer. Feed cost and total costs per 100 chickens increased as volume of fall and winter eggs increased. Total returns per 100 chickens increased at a more rapid rate than did costs. The group with the smallest proportion of fall and winter eggs suffered a loss of $4.55 per hundred annually, while the group with the largest proportion at this time of the year made a return of $78.78 over all costs.

TABLE 26.—Poultry: Proportion of Eggs Sold in Four Months, October to January, Inclusive, as Related to Costs, Returns, and Other Factors, by Groups of Farms, 1920-1924

Item	Percent of eggs sold October to January, inclusive		
	Less than 8	8 to 16	16 and over
Farms....No..	8	7	7
Average hens per flock....No..	77	107	104
Total chickens per farm....No..	116	186	173
Eggs sold, October to January, inclusive....Pct..	4.1	12.6	25.1
Annual egg production per hen....No..	59	87	112
Nutritive ratio of feed, other than range....	1:8.3	1:7.5	1:6.9
Per 100 chickens annually:			
Total concentrates fed....Lb..	5098	5628	6288
Digestible nutrients in feed....Lb..	3955	4532	5108
Digestible protein in feed....Lb..	474	608	736
Feed cost....Dol.	90.88	115.62	135.51
Labor....Hr..	180.0	192.0	188.7
Labor cost....Dol..	49.67	54.09	53.15
Total cost....Dol.	166.40	194.56	227.24
Total returns....Dol..	161.85	207.28	306.02
Returns above cost....Dol..	—4.55	13.28	78.78
Eggs produced....Doz.	327	419	560
Eggs, value....Dol..	100.71	141.85	217.03
Meat, value....Dol..	61.14	65.43	88.99
Proportion of poultry receipts from eggs....Pct.	62.2	68.4	70.9
Cost of eggs per dozen....Dol..	.316	.318	.288
Selling price of eggs per dozen....Dol..	.308	.339	.387
Return per hour of labor on poultry....Dol..	.25	.35	.70
Cost per dollar of returns from poultry....Dol..	1.03	.94	.74

Table 26 shows very conclusively that those farmers who so managed their poultry flocks as to have a heavy production during the season of high priced eggs were well paid for their efforts. Besides making enough to pay all other costs they received 70 cents an hour for all time devoted to the poultry flock, while the inefficient group made only 25 cents an hour. The yearly weighted average selling price of all eggs produced by the unprofitable flocks was 30.8 cents a dozen, and of the well-fed, well-managed, profitable flocks 38.7 cents.

EGG PRODUCTION PER HEN

In order to show the relation between egg production per hen and profits, these farms were divided into three groups based on production per hen (Table 27).

TABLE 27.—Poultry: Relation of Egg Production per Hen to Costs, Returns, and Other Factors, by Groups of Farms, 1920-1924

Item		Eggs per hen, annually		
		Under 60	60 to 100	100 and over
Farms	No.	7	7	8
Average hens per flock	No.	78	82	127
Total chickens per farm	No.	121	136	216
Annual egg production per hen	No.	48	83	115
Eggs sold, October to January, inclusive	Pct.	7.8	13.3	19.5
Nutritive ratio of feed, other than range	Lb.	1:8.4	1:7.8	1:6.9
Per 100 chickens, annually:				
Total concentrates fed	Lb.	4707	5616	6336
Digestible nutrients in feed	Lb.	3777	4390	5127
Digestible protein in feed	Lb.	448	560	743
Feed cost	Dol.	89.60	106.96	135.87
Labor	Hr.	163.7	188.9	201.6
Labor cost	Dol.	42.75	52.35	58.67
Total cost	Dol.	148.53	186.04	229.70
Total returns	Dol.	155.11	211.24	278.21
Returns above cost	Dol.	6.58	25.20	48.51
Eggs produced	Doz.	258	415	561
Eggs, value	Dol.	83.10	136.22	208.25
Meat, value	Dol.	72.01	75.02	69.96
Proportion of poultry receipts from eggs	Pct.	53.6	64.5	74.9
Cost of eggs per dozen	Dol.	.308	.289	.306
Selling price of eggs per dozen	Dol.	.322	.328	.371
Return per hour of labor on poultry	Dol.	.30	.41	.53
Return per dollar's worth of feed	Dol.	1.73	1.97	2.05
Cost per dollar of returns from poultry	Dol.	.96	.88	.83

Increased egg production per hen was accompanied by a larger proportion of eggs sold in the fall and winter, hence a higher average selling price. There was an increase in the amount of feed and a greater proportional increase in the amount of protein fed; the amount of labor expended per hundred birds was greater in the high producing flocks; and total costs per 100 chickens were about 50 percent greater in the high producing than in the low producing group. The returns above all costs, however, were more than seven times as great for the high producers. From every angle the high producing hen was more profitable than the low producing one.

SHEEP AND WOOL COSTS

Sheep were not a very important enterprise on these farms, accounting for only 2.7 percent of the total receipts of all farms studied. They were kept on only 6 of the 23 farms. Farm 1 had 62.5 percent of all the sheep on which records were secured, so the averages are influenced to a great extent by conditions on that farm.

In computing the average number of sheep, two lambs from lambing time to January 1 were considered equivalent to one ewe for an equal period of time. If the average number of lambs for the 9-month period from birth to December 31 on a certain farm was 40, these lambs were considered equivalent to 20 ewes for 9 months or 15 ewes for a year. Any lambs 8 to 10 months old on hand after January 1 were counted the same as mature sheep.

YEAR-TO-YEAR VARIATIONS IN COSTS AND RETURNS

Table 28 shows average costs for each of the 5 years. Costs in 1920 were very high, principally because of the high valuation on feeds. Wool returns were not high, neither of the two farmers marketing their wool until several weeks after the slump in the wool market which occurred about the middle of that year. Costs in 1921 were considerably lower, but returns from wool were smaller and the receipts from mutton were disastrously low.

TABLE 28.—Average Cost of Keeping a Sheep, Cost of Producing Wool, Returns From Sheep, and Cost per Dollar of Returns, by Years, 1920-1924

Item	Average for 5 years	1920	1921	1922	1923	1924
Number of farm records	18	2	4	3	4	5
Cost per sheep:						
Feed and pasture ....Dol..	8.08	13.51	7.16	5.50	5.71	7.18
Man labor. ....Dol..	1.28	1.30	1.43	1.07	1.28	1.25
Other costs....Dol..	1.91	1.64	1.53	2.13	2.06	2.45
Total ....Dol..	11.27	16.45	10.12	8.70	9.05	10.88
Manure credits....Dol..	.94	.95	1.02	.86	.77	1.03
Cost of mutton and wool ....Dol..	10.33	15.50	9.10	7.84	8.28	9.85
Mutton receipts per sheep ....Dol..	3.86	4.34	1.67	5.69	3.32	5.30
Wool per sheep:						
Value of wool ....Dol..	3.57	2.69	2.32	4.11	4.63	5.02
Cost of wool ....Dol..	4.96	5.92	5.30	3.29	4.82	4.79
Wool produced .. ....Lb...	9.7	8.9	9.8	8.7	10.3	11.1
Wool cost per pound....Dol..	.508	.662	.538	.378	.467	.430
Wool selling price per pound....Dol..	.366	.301	.236	.472	.449	.450
Total returns per sheep....Dol..	7.43	7.03	3.99	9.80	7.95	10.32
Cost per dollar of receipts from sheep....Dol..	1.39	2.20	2.28	.80	1.04	.95

For these few sheep raisers 1920 and 1921 were very unprofitable years. The following years were more favorable, for the prices of wool and lambs were getting back to a better level. Costs per sheep were lowest in 1922, total returns per sheep were highest in 1924. The year 1922 was the most profitable for this enterprise.

FARM-TO-FARM VARIATIONS IN COSTS AND RETURNS

Because of the abnormal conditions in 1920 and 1921 these two years were omitted from Table 29, which shows average costs and returns by farms for the remaining three years. Farm 9 had no

sheep in 1922 or 1923 and Farm 16 did not begin keeping records until 1923. The other three farms had sheep during the three years.

TABLE 29.—Sheep: Variations in Costs and Returns per Sheep, Cost per Pound of Wool and per Dollar Returns From Sheep, by Farms, 1922-1924

Farm	Average size of flock	Per mature sheep or equivalent, annually						
		Feed and pasture	Man labor		Other costs	Total cost	Manure credit	Net cost of mutton and wool
			Amount	Value				
	No.	*Dol.*	*Hr.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*
1	156.5	6.48	3.8	1.07	2.23	9.78	0.90	8.88
9	17.8	5.58	6.2	1.86	1.85	9.29	.82	8.47
4	27.4	3.27	4.9	1.32	2.37	6.96	.64	6.32
16	5.3	3.60	8.9	2.62	3.30	9.52	.75	8.77
8	22.7	7.83	7.7	1.59	1.84	11.26	1.17	10.09
Average	54.0	6.14	4.5	1.19	2.23	9.56	.89	8.67

Farm	Per mature sheep or equivalent, annually					Per pound of wool		Cost per $1 returns from sheep
	Total returns	Mutton receipts	Wool production			Selling price	Cost	
			Amount	Value	Cost			
	Dol.	*Dol.*	*Lb.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*
1	10.41	5.14	11.5	5.27	4.49	0.457	0.390	0.85
9	9.57	6.55	6.5	3.02	2.68	.461	.409	.89
4	5.32	2.31	6.6	3.01	3.57	.457	.542	1.19
16	7.25	3.07	10.1	4.18	5.06	.414	.501	1.21
8	7.50	4.90	5.2	2.31	3.24	.445	.624	1.40
Average	9.36	4.77	10.1	4.59	4.26	.456	.423	.93

Farm 1 had the lowest labor expenditure per sheep, as would be expected with this large a flock. Farm 4 had the next largest flock and next smallest amount of time spent per sheep. Feed costs ranged from $3.27 to $7.83 per sheep, averaging $6.14 per year. Net costs per sheep, after subtracting credit for manure, averaged $8.67, or 93 cents per dollar of returns. The annual returns from wool and mutton during this three-year period averaged $9.36 per sheep.

The table shows that the average annual receipts per sheep were $4.77 for mutton and $4.59 for wool, or about one-half from each. But the proportion varied considerably on the different farms, Farms 8 and 9 getting only about 32 percent and Farm 16 about 58 percent of the total sheep receipts from wool.

There are no separate costs of producing mutton and wool, the two being joint products of the same feed, labor, and other items of cost. The costs of the entire flock were allocated to these two

products in the same proportion that mutton and wool receipts were of the total flock income, this being considered an equitable distribution. Dividing the costs on this basis, it is found that the cost of producing wool varied from 39 cents to 62 cents per pound, the average being a little over 42 cents. The average selling price of wool during the three years was 45.6 cents per pound.

UNIT COST OF KEEPING A SHEEP

The quantities of feed and labor and the values of the feed, labor, and all other elements entering into the average cost of keeping a sheep are shown in Table 30.

TABLE 30.—Unit Cost of Keeping a Sheep a Year, Average of Five Farms, 1922-1924

Item of cost	Amount	Value	
		Per unit	Total
Feed:		*Dol.*	*Dol.*
Corn, shelled	91.0 lb.	1.33 per cwt.	1.21
Oats	71.8 lb.	1.43 per cwt.	1.02
Bran, etc.	.7 lb.	1.89 per cwt.	.01
Silage	190.3 lb.	4.80 per ton	.46
Hay	339.7 lb.	12.62 per ton	2.15
Stover	30.5 lb.	7.26 per ton	.11
Pasture	179.0 da.	.20 per mo.	1.17
Salt	1.7 lb.	.75 per cwt.	01
Total feed and pasture			6.14
Straw bedding	92.7 lb.	5.00 per ton	.23
Man labor	4.5 hr.	.265 per hr.	1.19
Horse work	.25 hr.	.199 per hr.	.05
Building charge			.58
Equipment charge			.27
Interest on sheep at 5 percent			.38
Taxes and insurance			.14
Overhead			.55
Miscellaneous			.03
Total annual cost per sheep			9.56
Manure credit			.89
Net cost of mutton and wool			8.67

Corn and oats were practically the only concentrates fed. Hay was the most important single item of feed, its value comprising 35 percent of the total value of all feed and pasture, which in turn was 64.2 percent of the total cost of keeping a sheep. Man labor was of minor importance, averaging 4½ hours annually per sheep and forming only 12.4 percent of the total cost; this item would probably be of even smaller relative importance in larger flocks. All other costs amounted to 23.4 percent of the total cost.

Factors related to profits from sheep.—Some of the factors affecting the profits from sheep on these five farms are shown in

Table 31. Chief of these are, on the one hand, the cost of keeping each sheep and, on the other, the various factors bearing on the receipts from the flock, the principal ones of which are the number of lambs raised per 100 ewes, the average weight of each fleece, and the average price received per pound of wool sold.

TABLE 31.—Sheep: Some Factors Affecting Profits From Sheep, by Farms, 1922-1924

Farm	Average size of flock	Labor per sheep	Net cost per sheep	Total returns per sheep	Lambs raised per 100 ewes	Mutton receipts per sheep	Wool per fleece	Per pound of wool		Cost per dollar receipts
								Selling price	Cost of production	
	No.	*Hr.*	*Dol.*	*Dol.*	*No.*	*Dol.*	*Lb.*	*Dol.*	*Dol.*	*Dol.*
1	156.5	3.8	8.88	10.41	91.5	5.14	9.7	0.457	0.390	0.85
9	17.8	6.2	8.47	9.57	86.7	6.55	8.5	.461	.409	.89
4	27.4	4.9	6.32	5.32	40.0	2.31	9.2	.457	.542	1.19
16	5.3	8.9	8.77	7.25	60.0	3.07	8.9	.414	.501	1.21
8	22.7	7.7	10.09	7.50	65.4	4.90	6.2	.445	.624	1.40
Average.....	54.0	4.5	8.67	9.36	80.7	4.77	9.3	.456	.423	.93

Farm 1 obtained the largest margin of profit. This farm incurred costs of 85 cents for each dollar of receipts from the sheep enterprise, a total cost per sheep just a trifle above the average of the entire group. The number of lambs raised per 100 ewes was 91.5, which was considerably higher than the average of the other farms, and the average weight per fleece was high, especially in view of the fact that the lambs were held over and shorn the following spring, so that 46 percent of the fleeces were lamb fleeces. Approximately 90 percent of the fattened lambs were sold, at about twelve months of age, during the last week of April or the first of May. The others were kept to replace the breeding ewes that were culled out or had died. The average weight of the lambs when sold was 76 pounds. The sheep on this farm were C-type, or Delaine Merinos, desirable for their combined mutton and fine-wool characteristics. On Farm 1, 75 percent of the wool graded as fine combing; lamb fleeces brought up the percentage of fine clothing grade, which has a shorter length of staple.

Farm 9 raised a fairly good number of lambs per 100 ewes. These sheep were bought to good advantage at a public sale in March 1924 and the ewes were sold at a good price in December of that year. Mutton receipts per sheep, which include the increase in value of the ewes, were higher on this farm than on the others.

Farm 4 had the lowest cost per sheep. The low feed and labor expenditure per sheep may account in part for the very small

number of lambs raised per 100 ewes. A fair average weight of fleece helps this farm when the farms are ranked according to profits made from sheep.

The small number of lambs raised and the low average price received per pound of wool were the chief factors in the ranking of Farm 16. Farm 8 had the highest cost per sheep, raised a small number of lambs per 100 ewes, and had the lightest fleeces of all.

HOG PRODUCTION COSTS

The hog enterprise, produced only 2.4 percent of the total farm receipts. Hog raising was more common, however, than sheep raising, 17 of the 23 farms keeping hogs all or part of the time. In the cost tables the data on 3 of the farms that had hogs were omitted, since the hogs were fed on these farms in 1920 only and yielded a very small part of the total income. About one-fifth of the pork produced on the other 14 farms was butchered for home consumption. The average weight of the hogs butchered was 178 pounds. As an average, only 1.2 brood sows were kept per farm, ranging from none at all on farms 2, 3, and 22 to four sows on Farm 21. The sows on these 14 farms farrowed an average of 12.1 pigs per sow annually, one-fifth of which died before weaning time. There was an average of 7.9 pigs farrowed per litter, of which 6.3 were saved. About three-fifths of all sows produced two litters a year. Two-thirds of all pigs raised were farrowed in the spring, one-third in the fall. In addition to the pigs raised, some of the farmers bought weanling pigs, at prices ranging from $3.00 to $5.00 each. One-half of these were bought in May and June, the others principally in October and November. One-fourth as many pigs were bought as were raised.

There was considerable variation in the weights at which hogs were marketed. Shotes were sold at an average of 170 pounds each, the weight on individual farms ranging from 107 to 221 pounds per head. Four of the farms made a practice of selling most of their pigs as soon as they were old enough to wean. These were bought in lots of two, three, four, or more, by other farmers in the neighborhood. The selling of weanling pigs brought down the average weight at which these four men sold all their pigs and shotes to about 80 pounds.

YEAR-TO-YEAR VARIATIONS IN COST OF PRODUCTION

Costs of production followed the trend in the price of corn during the period of the study, corn being the largest item in the cost of producing pork. Average total costs per hundred pounds of pork, live weight, varied as follows:

1920	$19.12
1921	10.35
1922	10.34
1923	11.28
1924	13.04

The average cost of production for the five years was $12.69 and the average selling price of hogs on these farms was $11.07 per hundred pounds.

FARM-TO-FARM VARIATIONS

There were wide variations in cost between different years and between different farms in the same year. Table 32 shows average production costs per hundred pounds on individual farms for the 5-year period. The cost of maintaining brood sows is included with the cost of the other hogs.

TABLE 32.—Hogs: Variations in Cost of Producing 100 Pounds of Pork, by Farms, 1920-1924

Farm	Pork produced per year	Cost per 100 pounds of marketable pork, live weight										
		Feed and pasture*	Man labor		Horse work	Building charge	Equipment charge	Interest	Taxes, insurance	Overhead	Other	Total
			Amt.	Value								
	Lb.	*Dol.*	*Hr.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*
13	2300	6.61	4.6	1.33	0.00	0.28	0.97	0.33	0.07	0.57	0.00	10.16
1	2546	7.33	5.5	1.55	.14	.26	.34	.26	.13	.54	.00	10.55
23	4355	8.02	5.5	1.64	.02	.28	.53	.12	.05	.41	.00	11.07
21	5353	8.65	5.2	1.61	.44	.42	.12	.22	.13	.48	.14	12.21
2	890	9.09	9.3	2.36	.05	.05	.07	.24	.03	.50	.00	12.39
10	4541	9.34	5.1	1.38	.02	.26	.75	.15	.04	.39	.10	12.43
14	1628	9.46	7.7	2.29	.19	.19	.09	.26	.05	.55	.00	13.08
3	831	10.59	8.7	2.25	.01	.51	.03	.35	.11	.63	.00	14.48
9	1401	9.16	12.5	3.62	.08	.41	.14	.31	.15	.62	.05	14.54
17	1212	11.83	7.0	2.18	.03	.25	.02	.15	.07	.23	.00	14.76
8	645	9.38	15.2	3.81	.10	.50	.52	.44	.08	.80	.00	15.63
16	762	9.43	16.6	4.30	.11	.02	.49	.29	.08	.67	.52	15.91
12	1134	11.95	11.0	3.27	.11	.41	.54	.18	.06	.55	.09	17.16
22	500	11.09	18.2	4.99	.12	.69	.03	.40	.07	.33	.00	17.72
Av.	1876	8.95	7.1	2.02	.12	.31	.41	.23	.08	.51	.06	12.69

*Feeds valued at uniform prices so as to make all farms comparable.

The total cost ranged from $10.16 to $17.72 a hundred pounds, a difference of $7.56 between the lowest and highest cost. Feed cost ranged from $6.61 on Farm 13 to $11.95 per hundred on Farm

12. Man labor varied from 4.6 hours per hundred pounds of gain on Farm 13 to 18.2 hours on Farm 22. The table shows that as the size of the hog enterprise decreased there was a decided tendency for the amount of labor expended per hundred pounds of pork to increase. On farms producing more than 2,000 pounds of pork per year, an average of 5.2 hours of man labor was spent per one hundred pounds of hogs produced; on those producing between 1,000 and 2,000 pounds, 9.9 hours; and on those producing less than 1,000 pounds, 11.7 hours. Those producing the larger quantities apparently were better feeders, producing 100 pounds at a feed cost of $8.65. The five small producers had a feed cost amounting to $9.87 per hundred pounds.

UNIT COST OF PRODUCING 100 POUNDS OF HOGS

Table 33 shows average quantities and value of feeds and other elements that entered into the cost of producing 100 pounds of live hogs.

TABLE 33.—Hogs: Unit Cost of Producing 100 Pounds of Gain in Weight, Average of 14 Farms, 1920-1924

Item of cost	Amount	Value	
		Per unit	Total
Feed:		*Dol.*	*Dol.*
Ear corn	315.9 lb.	0.99 per bu.	4.61
Shelled corn	41.6 lb.	.97 per bu.	.72
Oats	34.6 lb.	.53 per bu.	.57
Wheat	17.4 lb.	.94 per bu.	.27
Rye	4.8 lb.	1.14 per bu.	.10
Middlings	24.3 lb.	2.26 per cwt.	.55
Stale bread	20.9 lb.	1.15 per cwt.	.24
Tankage	7.3 lb.	3.65 per cwt.	.27
Oil meal	4.2 lb.	2.83 per cwt.	.12
Skimmilk	251.4 lb.	.49 per cwt.	1.23
Pasture			.19
Grinding			.08
Total feed and pasture			8.95
Man labor	7.1 hr.	.283 per hr.	2.02
Horse work			.12
Building charge			.31
Equipment charge			.41
Interest at 5 percent			.23
Taxes and insurance			.08
Overhead			.51
Miscellaneous			.06
Total cost per 100 pounds			12.69

Corn, not being grown in large quantities, was not as important an item in the feed cost on these farms as it is in the corn-belt section of the State. Corn was fed on all farms and made up 60 percent of the feed cost and 42 percent of the total cost of production. Skimmilk, fed in large quantities on the few farms that sold

cream, was the next most important feed and was one of the factors accounting for the relatively low grain requirement. Either wheat or oats or both were fed on all but one farm. Total concentrates, other than skimmilk, averaged 471 pounds per 100 pounds of hogs produced, varying from 316 pounds on Farm 10, where a large quantity of skimmilk was fed, to 770 pounds on Farm 17. Pasture was comparatively unimportant, hogs on most of the farms being closely confined because of the type and extent of the fences. Total feed and pasture averaged $8.95 per hundred pounds, or 70.5 percent of the total cost. Because of the small size of the hog enterprise on most of the farms the average cost of labor and other items ran high. Labor formed 15.9 percent and all other items 13.6 percent of the total cost.

SUMMARY

The net cost of keeping a cow, after subtracting credits for manure and calf, averaged $192.37 per year. Feed and pasture formed 51.8 percent of the total cost, labor 20.8 percent, and other items 27.4 percent.

The cost of producing milk on the different farms ranged from $2.13 to $3.98 per hundred pounds, with an average of $2.60. The average selling price was $2.67.

Herds averaging less than 6,000 pounds of milk per cow, annually, produced milk at a cost of $3.08, and those averaging more than 9,000 pounds, at a cost of $2.29 per hundred pounds.

The owners of the low producers made less than 11 cents an hour for the time spent on dairy cows, and the owners of the high producers made 51 cents an hour.

The average cow producing less than 6,000 pounds failed by $21.67 to pay the total cost of keeping her a year; the average cow in the class of more than 9,000 pounds returned $36.96 over all costs, including labor.

Herds freshening principally in the fall produced an annual average of 1,332 pounds of milk per cow more than the average in herds freshening mostly in the spring. It cost more to keep the cows in the fall freshening herds, but thy produced milk at a lower cost per hundred pounds.

Uniform production of milk thruout the year, which was closely associated with fall freshening, was secured at a lower cost per hundred pounds than was a widely fluctuating production. Higher average selling prices for milk and better distribution of labor were additional advantages of fall freshening.

The net cost of keeping a herd bull averaged $124.33 a year. The annual herd bull cost per cow was $7.32.

There was a wide variation in the profits from poultry, one farm making an annual return over all costs of $115 per 100 fowls, while another had a loss of $70 per 100 fowls.

Feed formed 57.8 percent of the average cost of the poultry enterprise, labor 24.2 percent, and other items 18.0 percent.

The cost of producing eggs varied from 19.7 cents to 53.2 cents, the average being 34.6 cents per dozen. The average selling price was 38.6 cents.

Farmers having 16 percent or more of their egg sales in the four high-price months of October to January, inclusive, made 70 cents an hour on their poultry enterprise, those having less than 8 percent of their annual sales at this time made 25 cents an hour. Feed cost per 100 birds was $45 more per year for the heavy fall-laying flocks, whereas their total returns were $145 more per year than for the flocks with the smallest percentage of eggs in the high-price months.

In flocks producing an average of 115 eggs per hen the costs were only 50 percent higher than in those producing an average of 48 eggs in a year, while the returns from the high producing flocks over all costs were seven times greater.

Feed was 64.2 percent of the cost of keeping sheep, labor only 12.4 percent, and other costs were 23.4 percent.

Size of flock, lambs raised per 100 ewes, and weight of wool per fleece were the principal factors affecting profits from sheep.

The cost of producing hogs varied from $10.16 to $17.72 per hundred pounds, the average being $12.69.

Feed was 70.5 percent of the total cost of producing pork, labor 15.9 percent, and other items 13.6 percent.